EPA United States
Environmental Protection Agency

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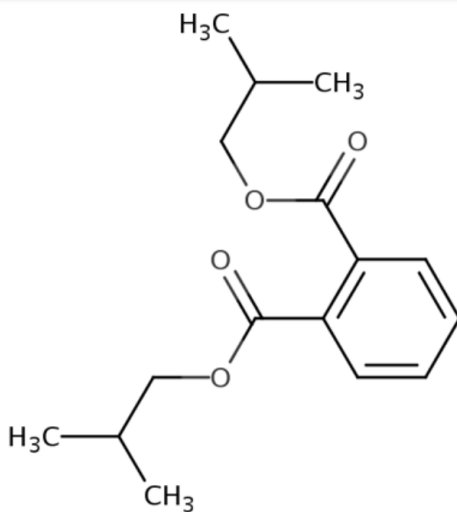Office of Chemical Safety and
Pollution Prevention

Data Quality Evaluation Information for
General Population, Consumer, and Environmental Exposure for
Di-isobutyl Phthalate (DIBP)
(1,2-Benzenedicarboxylic acid, 1,2-bis(2-methylpropyl) ester)

Systematic Review Support Document for the Draft Risk Evaluation

CASRN: 84-69-5

July 2025

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

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

Table of Contents

Study Citation:	Liu, W. X., Hu, J., Chen, J. L., Fan, Y. S., Xing, B., Tao, S. (2008). Distribution of persistent toxic substances in benthic bivalves from the inshore areas of the Yellow Sea. Environmental Toxicology and Chemistry 27(1):57-66.		
HERO ID:	165572		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Collected 1.5 kg per species of bivalve. Described sites, equipment, processing and storage.
Metric 2:	Analytical Methodology	Low	Followed China's national standards for collection and pretreatment, analytical method, and quality assessment. LOD not reported; apparently less than 1 ng/g wet weight, however.
Metric 3:	Biomarker Selection	Low	Soft tissue concentrations; wet weight concentrations; species of commercial importance; however, three phthalates combined concentrations reported. Different bivalve species combined for estimate of overall proportion of each phthalate.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	China Yellow Sea, primarily coastal. Mapped.
Metric 5:	Currency	Low	1999, August to September.
Metric 6:	Spatial and Temporal Variability	Medium	Spatial variation captured by 30 bivalve sampling locations: 28 coastal and 2 outer sea. Between 1 and 3 species collected per location. Each site, however, sampled only one time.
Metric 7:	Exposure Scenario	High	In situ bivalves, which are filter feeders. Species consumed by humans.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Low	Total concentration of three phthalates reported for each sampling location and species sampled (not individual phthalates); percent of total represented by each phthalate reported graphically after averaging across all species at location.
Metric 9:	Quality Assurance	High	Followed national guidelines for China; analysis in triplicate. For every set of 10 bivalve samples, a procedural blank and a spiked sample consisting of all the concerned chemicals were processed to test for possible interference and cross contamination. High recoveries.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	Discussed previously collected sediment samples and proximity to bivalve sampling locations. Discussion of local environment limited; many non-detects; two locations with high concentrations.

Overall Quality Determination   Medium

Study Citation:		Hines, E. P., Calafat, A. M., Silva, M. J., Mendola, P., Fenton, S. E. (2009). Concentrations of phthalate metabolites in milk, urine, saliva, and serum of lactating North Carolina women. Environmental Health Perspectives 117(1):86-92.	
HERO ID:		194817	

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	pilot study for EPA methods Advancement for Milk Analysis; IRB approval; collection described
	Metric 2: Analytical Methodology	High	methods and instruments described; LOD and LOQ provided; performed the preparation of standard solutions, quality control (QC) verification, sample preparation, and instrumental analyses as previously described (Calafat et al. 2004)
	Metric 3: Biomarker Selection	High	Various matrix types collected. Metabolite measurement in urine is particularly known to be well correlated to phthalate exposures.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	U.S.
	Metric 5: Currency	Low	2004-2005
	Metric 6: Spatial and Temporal Variability	Medium	(visit 1 milk samples, n = 18; visit 2 milk samples, n = 20; visit 1 other fluids, n = 33; visit 2 other fluids, n = 30; no replicates mentioned
	Metric 7: Exposure Scenario	High	human biomonitoring
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	10th, 25th, median, 75th, 90th, 95th percentile provided
	Metric 9: Quality Assurance	Medium	quality control (QC) verification
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	variability and uncertainty not described, no obvious concerns

Overall Quality Determination   High

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: | Palmquist, H., Hanaeus, J. (2005). Hazardous substances in separately collected grey- and blackwater from ordinary Swedish households. Science of the Total Environment 348(1-3):151-163. |
| **HERO ID:** | 508379 |

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	sampling described, diagram included
Metric 2:	Analytical Methodology	Medium	accredited contract laboratory, LOD included (table 6), no instrument details- may be detailed in lab reference
Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Sweden
Metric 5:	Currency	Low	2004
Metric 6:	Spatial and Temporal Variability	Medium	No. of samples: greywater 4, blackwater 3. Unclear if there are replicates.
Metric 7:	Exposure Scenario	Medium	greywater and blackwater in households
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	average, min, max. Individual points not reported.
Metric 9:	Quality Assurance	Low	quality assurance not discussed, no obvious concerns
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Temporal variation analyzed (fig 4). There is mention of budget limitations.

Overall Quality Determination   Medium

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:	Wang, Y. Q., Hu, W., Cao, Z. H., Fu, X. Q., Zhu, T. (2005). Occurrence of endocrine-disrupting compounds in reclaimed water from Tianjin, China. Analytical and Bioanalytical Chemistry 383(5):857-863.		
HERO ID:	533749		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	1 L water sample collected at each stage of treatment of reclaimed water plant which receives secondary treatment wastewater (mainly domestic) from the Jizhuangzi sewage treatment plant; 5 mL methanol added; points of collection Fig 2
	Metric 2:	Analytical Methodology	Medium	solid phase extraction; GC-MS; compounds identified by retention times (Table 3); 0.13–0.2 μg/L for phthalates
	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	Tianjin, northern China
	Metric 5:	Currency	Low	October 2003 - September 2004
	Metric 6:	Spatial and Temporal Variability	Medium	7 rounds of sampling over a year
	Metric 7:	Exposure Scenario	High	water samples from reclaimed water plant intended for landscaping impoundment use and urban miscellaneous water consumption
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 4 provides the mean and range of concentrations at 4 points during treatment process (influent to after ozonation) as well as the removal efficiency; p. 862 discusses results of phthalates; no raw data provided
	Metric 9:	Quality Assurance	Medium	recoveries ranged from 83%-94%
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	results comparable to levels previously reported; influent water samples varied by season; recoveries relative std deviation of below 9%

Overall Quality Determination   **Medium**

Study Citation: Becker, K., Guen, T., Seiwert, M., Conrad, A., Pick-Fub, H., Muller, J., Wittassek, M., Schulz, C., Kolossa-Gehring, M. (2009). Geres IV: Phthalate metabolites and bisphenol a in urine of German children. International Journal of Hygiene and Environmental Health 212(6):685-692.

HERO ID: 551773

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Children's urine samples were taken by parents or themselves and key sampling methods and conditions were reported. Sampling methodology is clear and appropriate.
	Metric 2:	Analytical Methodology	High	Analytical methodologies were from published paper. Key information such as LOQs, standard measurements, instruments, extraction methods were reported. No recovery sample reported.
	Metric 3:	Biomarker Selection	High	Mono-iso-butylphthalate (MiBP) as measured metabolite.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Germany
	Metric 5:	Currency	Medium	Samples collected between May 2003 and May 2006.
	Metric 6:	Spatial and Temporal Variability	Medium	Morning urine samples collected. >10 samples but no replicates collected.
	Metric 7:	Exposure Scenario	High	GerES IV used questionnaires to collect exposure information. Possible exposure scenario discussed.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not provided. Lack of variation report (SD).
	Metric 9:	Quality Assurance	High	Internal and external QC process applied and reported in "Methods" > "Chemical analysis" section.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited discussion about uncertainty and variability but not likely to have substantial impact on the results.

Overall Quality Determination   High

| Study Citation: | Matthiessen, P., Thain, J. E., Law, R. J., Fileman, T. W. (1993). Attempts to assess the environmental hazard posed by complex mixtures of organic chemicals in UK estuaries. Marine Pollution Bulletin 26(2):90-95. |
| **HERO ID:** | 660286 |

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Methods briefly described and cited: Law et al. (1991) and Hurfordet al. (1989).
	Metric 2:	Analytical Methodology	Low	GC-MS; equipment not described.
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	United Kingdom
	Metric 5:	Currency	Low	1988-1989
	Metric 6:	Spatial and Temporal Variability	Medium	1 sample at 10 locations
	Metric 7:	Exposure Scenario	Medium	surface waters from several UK estuaries
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	raw data provided Table 1
	Metric 9:	Quality Assurance	Low	QA not explicitly discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty not discussed.

Overall Quality Determination   Low

Study Citation:	Berman, T., Hochner-Celnikier, D., Calafat, A. M., Needham, L. L., Amitai, Y., Wormser, U., Richter, E. (2009). Phthalate exposure among pregnant women in Jerusalem, Israel: results of a pilot study. Environment International 35(2):353-357.		
HERO ID:	673439		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Sampling methodology details reported for sampling procedure, sample storage conditions and duration of sample storage prior to analyses. Insufficient information regarding sampling equipment
Metric 2:	Analytical Methodology	Medium	Analytic methodology details reported for extraction method, analytical instrumentation, chemical-specific limits of detection and matrix-adjustment method for urine sample analyses. Insufficient information regarding instrument calibration.
Metric 3:	Biomarker Selection	High	Sampling for metabolites specific for parent chemicals (DIDP, DINP, DIBP, DEHP).
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Urine samples collected from participants in Jerusalem
Metric 5:	Currency	Medium	Urine samples collected at recruitment in 2006.
Metric 6:	Spatial and Temporal Variability	Medium	Single spot urine specimens collected from pregnant women (n=19) in Jerusalem hospital settings across different areas of city.
Metric 7:	Exposure Scenario	Medium	Authors noted participants came from diverse ethnic and socioeconomic backgrounds, with results reported stratified across age of residential building as well as for use of personal care products. Occupational data obtained from extensive questionnaire.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Statistical summary measures of urinary metabolite total number of samples, geometric mean, median, and concentration ranges reported. Description of data in terms of year of sampling, location and population characteristics summarized. Insufficient information regarding raw data and consideration for tests for outliers.
Metric 9:	Quality Assurance	Medium	Quality assurance details reported for sample analytics, reagent blanks and protocols. Results adjusted for creatinine. Lack of pre-exposure sampling and reporting of recovery data.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Statistical summary measures lacked standard deviations but reported ranges, limitations of sample size and spot urine specimens discussed.

Overall Quality Determination   **Medium**

Study Citation:	Bornehag, C. G., Sundell, J., Weschler, C. J., Sigsgaard, T., Lundgren, B., Hasselgren, M., Hägerhed-Engman, L. (2004). The association between asthma and allergic symptoms in children and phthalates in house dust: A nested case-control study. Environmental Health Perspectives 112(14):1393-1397.		
HERO ID:	673441		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Medium. Most key criteria met; lack of sample storage conditions/duration information.
	Metric 2: Analytical Methodology	Medium	Medium. Most key criteria described, detection limits reported.
	Metric 3: Biomarker Selection	N/A	N/A. Sampling for parent chemical in environmental media (dust).
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	High. Samples provided by participants in Varmland, Sweden.
	Metric 5: Currency	Low	Low. Sample collection dates noted as October, 2001 through April, 2002.
	Metric 6: Spatial and Temporal Variability	Medium	Medium. Single dust concentration sampling results from 346 homes with dust sampled from molding and shelves of participating child's bedroom, with sampling conducted within single season of 2001-2002. Non-statistical sampling methods.
	Metric 7: Exposure Scenario	Low	Low. Dust concentrations measured within participating child's bedroom with samples obtained from molding and shelves of bedroom with additional microenvironment data not provided.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Medium. Most key criteria met; lack of raw data and variation measure (other than 95% confidence interval across case-control status.
	Metric 9: Quality Assurance	Medium	Medium. Some key criteria met; lack of baseline pre-exposure sampling, DBH study methods referenced.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Medium. Variability characterized within summary statistics (95% confidence interval), potential study limitations and biases discussed.

Overall Quality Determination   **Medium**

Study Citation:	Hogberg, J., Hanberg, A., Berglund, M., Skerfving, S., Remberger, M., Calafat, A. M., Filipsson, A. F., Jansson, B., Johansson, N., Appelgren, M., Hakansson, H. (2008). Phthalate diesters and their metabolites in human breast milk, blood or serum, and urine as biomarkers of exposure in vulnerable populations. Environmental Health Perspectives 116(3):334-339.		
HERO ID:	673465		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Sample selection (women invited to participate) based on 130 consecutive normal births in one hospital, not stratified to represent general population characteristics of Sweden overall.
Metric 2:	Analytical Methodology	High	GC-MS; sample prep and extraction described in detail by matrix
Metric 3:	Biomarker Selection	High	Measured parent phthalates and their metabolites in breast milk, blood (or plasma), and urine.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Sweden
Metric 5:	Currency	Low	Samples collected in 2001
Metric 6:	Spatial and Temporal Variability	High	Cohort of Swedish women that delivered at Lund University Hospital, 130 consecutive deliveries invited to participate; final n = 42. Time span (dates) unspecified; single hospital.
Metric 7:	Exposure Scenario	Medium	General population of pregnant Swedish women after delivery in hospital; all interviewed about lifestyle habits, use of hygiene and other products, and other relevant information.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Reported mean, SD, n, min, max, median, 75th percentile, and LOD by chemical and matrix. Raw data not provided.
Metric 9:	Quality Assurance	High	At Swedish institutes, calibration and recoveries from standard mixture of 6 phthalate esters; reported concentrations corrected for recovery. Precision, uncertainty, and recovery rates reported; high and low quality assurance spiked samples; reagent blanks included. Several techniques used to minimize contamination from sample collection through analysis.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Discussed results and correlations (or lack thereof) in conjunction with factors that might account for them.

Overall Quality Determination   **High**

Study Citation:	Lomenick, J. P., Calafat, A. M., Melguizo Castro, M. S., Mier, R., Stenger, P., Foster, M. B., Wintergerst, K. A. (2010). Phthalate exposure and precocious puberty in females. Journal of Pediatrics 156(2):221-225.		
HERO ID:	673478		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Medium. Sampling methodology described in terms of urine sampling equipment container materials, sample storage conditions prior to analysis, study site (pediatric endocrinology clinic). Insufficient information regarding duration of sample storage prior to analysis.
	Metric 2:	Analytical Methodology	Low	Low. Analytic methodology described in main text in terms of extraction, analytical instrumentation, use of instrument calibration standards, and matrix-adjustment method (creatinine). Investigators reported limits of detection as a range within "low nanogram per milliliter range" but did not specify numeric range. Samples specified as analyzed at the Centers for Disease Control and Prevention (CDC). Insufficient information regarding sample recoveries and numeric specification of limits of detection.
	Metric 3:	Biomarker Selection	High	MiBP metabolite of DIBP parent phthalate.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	High. Samples provided by participants recruited from the University of Kentucky College of Medicine Department of Pediatric Endocrinology.
	Metric 5:	Currency	Medium	Medium. Recruitment specified as between 2005-2008.
	Metric 6:	Spatial and Temporal Variability	Low	Low. Single, spot urine samples collected from 28 central precocious puberty (CPP) cases and 28 control children.
	Metric 7:	Exposure Scenario	Medium	Medium. Participant demographic and baseline weight, height and BMI characteristics summarized within Table 1. Authors noted urinary phthalate metabolite concentrations similar to children of similar ages within NHANES 2001-2002.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Medium. Urinary phthalate metabolite concentrations reported with summary statistics of mean and standard error in CPP case and control children with years of recruitment, number of samples and location of clinic collecting sample specified. Insufficient information regarding phthalate metabolite concentration range or percentiles, frequency of detection, tests for outliers and raw data.
	Metric 9:	Quality Assurance	Medium	Medium. Quality assurance procedures of internal standards utilized to increase precision, calibration standards used within each analytical run, reagent blanks and quality control materials of high and low concentration to monitor for accuracy and precision. CDC analysts blinded to participant characteristics. Phthalate metabolite concentrations corrected for creatinine. Insufficient information regarding field, laboratory or storage recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Medium. Statistical variability summarized within phthalate metabolite concentration summary statistic of standard deviation. Investigators presented a relatively robust discussion of study limitations and reasoning for results. Authors detailed uncertainty in importance of timing of phthalate sampling in adequately representing the intensity, duration and potential peak exposures responsible for initiation and development of CPP case status.

Overall Quality Determination   **Medium**

Study Citation:	Meeker, J. D., Hu, H., Cantonwine, D. E., Lamadrid-Figueroa, H., Calafat, A. M., Ettinger, A. S., Hernandez-Avila, M., Loch-Caruso, R., Tellez-Rojo, M. M. (2009). Urinary phthalate metabolites in relation to preterm birth in Mexico city. Environmental Health Perspectives 117(10):1587-1592.		
HERO ID:	673483		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Sampling methodology only briefly discussed in terms of spot urine, second morning void, sampling. Insufficient information not likely to impact results includes details on sampling equipment, sample storage conditions, and duration of sample storage.
	Metric 2: Analytical Methodology	Medium	Analytic methodology described and referenced (Silva et al., 2007) in terms of extraction, analytical instrumentation, limit of detection (LOD) range, and matrix adjustment (creatinine and specific gravity). Insufficient information regarding recoveries.
	Metric 3: Biomarker Selection	High	Sampled for metabolites of parent chemicals (DEHP, DIBP, DINP, DIDP).
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Samples provided by participants in Mexico City prenatal clinics.
	Metric 5: Currency	Low	Recruitment during pregnancy 2001-2003.
	Metric 6: Spatial and Temporal Variability	Low	A total of n=30 preterm birth cases and n=30 normal gestational birth controls, however single spot, second morning urine samples collected from participants.
	Metric 7: Exposure Scenario	Medium	Participant demographic data collected and reported. Potential sources of exposure briefly discussed.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Statistical summary measures of number of samples, concentration percentiles, maximum concentration, measures of central tendency of geometric mean and median concentrations and frequency of detection reported. Insufficient information regarding tests for outliers and raw data.
	Metric 9: Quality Assurance	Medium	Authors reported quality assurance and control parameters of use of calibration standards, reagent blanks and quality control materials in analytic procedures quantifying chemicals of interest. Authors noted urine samples of women delivering at term were more dilute than those of women delivering preterm, as well as other potential study limitations. Authors noted high percentage (33%) of samples <LOD for MCOP and MCNP.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Authors reported statistical summary measures of variation, uncertainties were minimal, and authors discussed study limitations.

Overall Quality Determination   Medium

Study Citation:	Adibi, J. J., Whyatt, R. M., Williams, P. L., Calafat, A. M., Camann, D., Herrick, R., Nelson, H., Bhat, H. K., Perera, F. P., Silva, M. J., Hauser, R. (2008). Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples. Environmental Health Perspectives 116(4):467-473.		
HERO ID:	673513		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Sampling equipment, procedures, storage conditions and duration, calibration of sampler and study site characteristics depicted
Metric 2:	Analytical Methodology	Low	The study analyzed sample using LC-MS. LOD calculation was provided but the numbers were not provided.
Metric 3:	Biomarker Selection	High	Biomarker (parent chemical or metabolite) is derived from exposure to the chemical of interest.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	3 New York City neighborhoods
Metric 5:	Currency	Low	The study did not provide a date of sampling, but publication date is available - 2008.
Metric 6:	Spatial and Temporal Variability	High	96 personal air samples, 16 mother urine samples, 19 newborn urine samples.
Metric 7:	Exposure Scenario	High	The data closely represent relevant exposure scenario (population/scenario/media of interest).
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Mean concentrations were reported with the standard errors.
Metric 9:	Quality Assurance	Low	Quality assurance/quality control techniques and results were not directly discussed, but can be implied through the study's use of standard field and laboratory protocols.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Authors compared results to published data. Methods to analyze urine variability was provided.

Overall Quality Determination   Medium

Study Citation:	Latini, G., Wittassek, M., Del Vecchio, A., Presta, G., De Felice, C., Angerer, J. (2009). Lactational exposure to phthalates in Southern Italy. Environment International 35(2):236-239.		
HERO ID:	673525		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Sampling methodology described in terms of sampling equipment, procedures, sample storage conditions and study site characteristics for in-hospital collection of breast milk samples. Insufficient information regarding duration of sample storage prior to analysis of breast milk samples.
Metric 2:	Analytical Methodology	High	Analytical methodology described in terms of extraction, analytical instrumentation, instrument calibration, chemical-specific limits of detection, recoveries and matrix adjustment (milk fat removal). LOQ/LOD provided in written form under "2.2 Chemical analysis."
Metric 3:	Biomarker Selection	High	Sampling for breast milk phthalate metabolites specific for parent chemicals.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Breast milk samples provided by participants in Brindisi and Tricase areas of Southern Italy.
Metric 5:	Currency	Medium	Participant samples described as collected during March and September 2006.
Metric 6:	Spatial and Temporal Variability	Medium	Single breast milk samples described as collected from random selection of 62 healthy mothers. Sampling conducted during one month of Spring and Fall seasons in 2006.
Metric 7:	Exposure Scenario	Medium	Participant characteristics of age reported. Potential phthalate sources discussed generally in introduction
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Median, 95% confidence interval, maximum, and 95th percentile summary measures of phthalate concentrations reported along with number of samples and a description of data sampling location (hospital) and sampling month/year. Insufficient information regarding raw data.
Metric 9:	Quality Assurance	High	Quality assurance parameters and quality control procedures reported. Internal laboratory quality control samples conducted for each analytic series. Laboratory recoveries reported. Procedures for sample collection noted avoiding use of latex gloves and/or breast pumps with participant assistance in hospital by a nurse, cleaning of breast prior to sampling and noted avoidance of use of cleansers or ointments. Sample collection noted use of glass and polypropylene devices with authentic rubber seals and stoppers.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Statistical summary measures of variability reported. Authors noted comparability of findings with previous studies, and discussed the lack of elimination of potential esterase activity in the milk resulting in potential contamination by phthalate diesters and subsequent hydrolysis to the monoesters during collection. However, this enzyme activity was assumed to be minimal due to -25°C storage and immediate treatment with phosphoric acid to eliminate all hydrolase activity.

Overall Quality Determination   High

Study Citation:	Sathyanarayana, S., Calafat, A. M., Liu, F., Swan, S. H. (2008). Maternal and infant urinary phthalate metabolite concentrations: Are they related?. Environmental Research 108(3):413-418.		
HERO ID:	673527		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Medium. Sampling methodology described in terms of sampling equipment for infant samples, procedures, study site (clinic), and sample storage conditions. Insufficient information regarding duration of maternal and infant urine sample storage prior to analysis.
	Metric 2: Analytical Methodology	Medium	Medium. Analytical methodology described in terms of extraction analytical instrumentation, instrument calibration, chemical-specific limits of detection and creatinine-adjustment. Insufficient information regarding sample recoveries. LODs provided as a range for all metabolites.
	Metric 3: Biomarker Selection	High	Low. Sampling for metabolites not specific to one parent chemical.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	High. Urine samples provided by participants from California, Missouri, Iowa, and Minnesota.
	Metric 5: Currency	Low	Low. Dates of urine specimen collection from SFFII study not specified. Publication date 2008.
	Metric 6: Spatial and Temporal Variability	Medium	Medium. Urine specimens provided by n=210 maternal-infant pairs. Participants resided in four different states. Single spot urine specimens provided by both mothers and infants. Insufficient information regarding timing of sample (first morning) for mothers. Non-statistical sampling approach with participants from original SFFI study that were eligible to participate within SFFII. No replicates
	Metric 7: Exposure Scenario	High	Medium. Demographic characteristics of mothers and infants provided in Table 1. Potential sources of exposure discussed in introduction and discussion.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Medium. Statistical summary measures of number of samples and geometric mean phthalate concentrations along with location (state) of sampling and frequency of detection presented for mothers and infants. Results presented as creatinine adjusted and unadjusted concentrations. Insufficient information regarding dates of sampling, range of concentrations or percentiles, measure of variation, tests for outliers within regression analyses and raw data.
	Metric 9: Quality Assurance	Medium	Medium. Quality assurance discussed in terms of sampling equipment prescreening for monoester phthalate metabolites, laboratory quality control and reagent blank samples. Insufficient information regarding recoveries.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Low	Low. Statistical variability measures for reported concentrations (standard deviations) lacking. Some study limitations regarding creatinine, lack of home environmental or dietary phthalate measures discussed.

Overall Quality Determination   Medium

Study Citation:	Ye, X., Pierik, F. H., Hauser, R., Duty, S., Angerer, J., Park, M. M., Burdorf, A., Hofman, A., Jaddoe, V. W., Mackenbach, J. P., Steegers, E. A., Tiemeier, H., Longnecker, M. P. (2008). Urinary metabolite concentrations of organophosphorous pesticides, bisphenol A, and phthalates among pregnant women in Rotterdam, the Netherlands: The Generation R study. Environmental Research 108(2):260-267.		
HERO ID:	673535		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Sample collection followed the methodology from the Generation R cohort study
Metric 2:	Analytical Methodology	High	The analytical method is described and the LOD reported.
Metric 3:	Biomarker Selection	High	Urine MiBP
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Netherlands
Metric 5:	Currency	Low	2004
Metric 6:	Spatial and Temporal Variability	Medium	No sample replicates. Urinary phthalate metabolites of 100 women
Metric 7:	Exposure Scenario	High	Exposure to phthalate metabolites in pregnant women from Netherlands
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	No individual data points reported. Table 3 reports creatinine adjusted metabolites: GM, GSD, Min, Max and percentiles
Metric 9:	Quality Assurance	High	QA/QC included the analysis of control samples and interlaboratory calibrations
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Key limitations reported. Variability of population reported in table 3

Overall Quality Determination   High

Study Citation:	Bornehag, C. G., Lundgren, B., Weschler, C. J., Sigsgaard, T., Hagerhed-Engman, L., Sundell, J. (2005). Phthalates in indoor dust and their association with building characteristics. Environmental Health Perspectives 113(10):1399-1404.		
HERO ID:	674952		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	High. Key criteria met, sample storage duration noted as 2-3 days.
Metric 2:	Analytical Methodology	Medium	Medium. Most key criteria described, detection limits reported but not for each chemical, analytic methods referenced.
Metric 3:	Biomarker Selection	N/A	N/A. Sampling for parent chemical in environmental media (dust).
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	High. Samples provided by participants in Varmland, Sweden.
Metric 5:	Currency	Low	Low. Sample collection dates noted as October, 2001 through April, 2002.
Metric 6:	Spatial and Temporal Variability	Medium	Medium. Single dust concentration sampling results from 346 homes with dust sampled from molding and shelves of participating child's bedroom, with sampling conducted within single season of 2001-2002. Non-statistical sampling methods. Unclear if there are replicates.
Metric 7:	Exposure Scenario	Medium	Low. Dust concentrations measured within participating child's bedroom with samples obtained from molding and shelves of bedroom with additional microenvironment data not provided.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Medium. Most key criteria met; lack of raw data.
Metric 9:	Quality Assurance	Low	Medium. QA not directly stated. Some key criteria met; lack of baseline pre-exposure sampling, DBH study methods referenced.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Medium. Variability characterized within summary statistics (95% confidence interval), variation in surface and wall material, potential study limitations and biases discussed.

Overall Quality Determination   **Medium**

Study Citation:	Cousins, A. P., Remberger, M., Kaj, L., Ekheden, Y., Dusan, B., Brorstroem-Lunden, E. (2007). Results from the Swedish National Screening Programme 2006. Subreport 1: Phthalates. GRA and I(GRA and I):39.		
HERO ID:	675060		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Samples of air (no other media) collected both from background and phthalate source areas; quantity of air collected per sample not specified (flow rate 1 m3/hr, duration NS).
Metric 2:	Analytical Methodology	Low	Data on target ion and qualifier ion in MS not provided.
Metric 3:	Biomarker Selection	N/A	DIBP metabolites not analyzed. Only analyzed for MEHP.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Sweden.
Metric 5:	Currency	Medium	2006.
Metric 6:	Spatial and Temporal Variability	Low	Twelve air sample locations: 3 background, 3 urban, 3 near Gislaved point source, and 3 near Stenungsund point source.
Metric 7:	Exposure Scenario	High	Relevant to human inhalation exposure.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Concentrations reported graphically or by range and detection frequency depending on the medium.
Metric 9:	Quality Assurance	Low	Precautions taken against contamination of equipment; no other discussion of quality assurance; chromatogram spread with mixture of isomers introduced noise.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty not discussed; reader make some inferences from bar graphs.

Overall Quality Determination   Medium

Study Citation:	Xie, Z., Ebinghaus, R., Temme, C., Lohmann, R., Caba, A., Ruck, W. (2007). Occurrence and air-sea exchange of phthalates in the Arctic. Environmental Science & Technology 41(13):4555-4560.		
HERO ID:	675521		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Described air and water samplers which seems appropriate but is not discussed in detail. Missing equipment calibration and storage information.
	Metric 2: Analytical Methodology	Medium	Provide detection limits; used gas chromatography and mass spectrometry (GC-MS). Analytical methods described in another study.
	Metric 3: Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	North Sea to the high Arctic (60° N-85°N); includes map
	Metric 5: Currency	Low	2004
	Metric 6: Spatial and Temporal Variability	Medium	16 water samples and 6 air samples.
	Metric 7: Exposure Scenario	High	Phthalates are known to degrade in water and have long-range atmospheric transport potential so they measured air and seawater samples.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	High	Provided concentration mean, median, minimum, and maximum. Individual raw data points in S1.
	Metric 9: Quality Assurance	High	"The analytical quality of the data was guaranteed through the use of field blanks to derive method detection limits (MDLs), breakthrough testing of air sampling, and the recoveries of surrogates." Recoveries were > 70%
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Briefly mention uncertainty limit, uncertainty calculated. Provided minimums and maximums so can understand the range of data.

Overall Quality Determination   **Medium**

| Study Citation: | Sathyanarayana, S., Karr, C. J., Lozano, P., Brown, E., Calafat, A. M., Liu, F., Swan, S. H. (2008). Baby care products: possible sources of infant phthalate exposure. Pediatrics 121(2):e260-268. |
| **HERO ID:** | 676348 |

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Most key criteria met, insufficient urine sample storage information.
	Metric 2: Analytical Methodology	Medium	Key criteria met. LOD's reported as range.
	Metric 3: Biomarker Selection	High	Metabolites specific for parent chemical.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Urine samples provided by children in MO, MN and CA.
	Metric 5: Currency	Low	1999-2002.
	Metric 6: Spatial and Temporal Variability	Medium	Urine samples from children in three states, single spot samples, 163 children.
	Metric 7: Exposure Scenario	Medium	Participant demographics reported.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Most key criteria reported, lacking raw data.
	Metric 9: Quality Assurance	Medium	QA parameters briefly discussed, no issues reported.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Variability characterized, limitations discussed.

Overall Quality Determination   Medium

Study Citation:	Aguayo, S., Munoz, M. J., de La, T. A., Roset, J., de La, P. E., Carballo, M. (2004). Identification of organic compounds and ecotoxicological assessment of sewage treatment plants (STP) effluents. Science of the Total Environment 328(1-3):69-81.		
HERO ID:	679135		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Samples of effluent, simple description.
Metric 2:	Analytical Methodology	High	Solid phase extraction; GC/MS.
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	Spain, Madrid
Metric 5:	Currency	Low	June, July 2000
Metric 6:	Spatial and Temporal Variability	Medium	N = 7 sewage treatment plants (STPs): one 24-hour composite samples (twelve 2-L samples taken every 2 hours); also one 10-L grab sample at two facilities.
Metric 7:	Exposure Scenario	Low	Effluent not an exposure medium (diluted by receiving water).
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Low	Reported # (%) of facilities (out of 7) for which chemical was detected in effluent and approximate DL.
Metric 9:	Quality Assurance	Low	Not described, but "detection" was the only endpoint.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	Limited to proportion of 7 facilities for which chemical was detected in effluent.

Overall Quality Determination   Low

Study Citation:	Fromme, H., Bolte, G., Koch, H. M., Angerer, J., Boehmer, S., Drexler, H., Mayer, R., Liebl, B. (2007). Occurrence and daily variation of phthalate metabolites in the urine of an adult population. International Journal of Hygiene and Environmental Health 210(1):21-33.		
HERO ID:	679517		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Medium. Most key criteria met. Lack of sample duration data.
Metric 2:	Analytical Methodology	Medium	Medium. Most key criteria met. Lack of sample recovery data.
Metric 3:	Biomarker Selection	High	High. Metabolites specific for parent chemicals
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	High. Munich, Germany.
Metric 5:	Currency	Medium	Medium. 2005
Metric 6:	Spatial and Temporal Variability	Medium	Medium. Replicate morning urine samples from 27 female and 23 male subjects in Munich, Germany on 8 consecutive days, for a total of 399 samples.
Metric 7:	Exposure Scenario	Medium	Medium. Demographics of participants reported, participants described as not occupationally exposed to phthalates.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Medium. Most key criteria met. Lack of raw data.
Metric 9:	Quality Assurance	Low	Low. Q/A not discussed.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	Medium. Characterization of within-subject variability, study limitations not directly discussed.

Overall Quality Determination   Medium

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:	Desideri, P., Lepri, L., Checchini, L. (1991). Organic compounds in sea water and pack ice in Terra Nova Bay (Antarctica). Annali di Chimica 81(7-8):395-416.		
HERO ID:	680261		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	sampling method seems appropriate but could be described in more detail; discuss depth sampled, coring, and filtration methods
	Metric 2: Analytical Methodology	Low	describe high resolution gas chromatography/GC-MS and analysis; compare concentrations to detection limits but don't specify what the detection limits are
	Metric 3: Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Terra Nova Bay (Antarctica)
	Metric 5: Currency	Low	1988/1989
	Metric 6: Spatial and Temporal Variability	Medium	10 samples. No replicates.
	Metric 7: Exposure Scenario	Medium	phthalates are present world-wide and considered a universal pollutant in the environment
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	individual concentration raw data provided however no summary stats
	Metric 9: Quality Assurance	Low	quality assurance/quality control methods not directly discussed however they do provide recovery percentages (but half <70%)
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	only provide standard deviations for the recovery percentages; no discussion of variability or limitations. Variability in different types of water types.

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:	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	Concentrations in food not reported. Individual DIBP intake estimated as median of 7 daily results; Table 2 lists min, max, median, and 95th percentile of the 50 individual median intakes.
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 DIBP intakes not discussed.

Overall Quality Determination   Medium

Study Citation:	Law, R. J., Fileman, T. W., Matthiessen, P. (1991). Phthalate esters and other industrial organic chemicals in the North and Irish Seas. Water Science and Technology: Water Supply 24(10):127-134.		
HERO ID:	680327		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Low	surface water sampled in vicinities of tees Bay, Plymouth Sound and Liverpool Bay (fig 1); unfiltered; sampling details previously reported in Hurford 1989; no details provided in this document
Metric 2:	Analytical Methodology	Low	extracted with dichloromethane; GC/MS in multiple ion detection mode; extracts dried and stored at -20C; analytical technique reported previously in Hurford 1989; no detection limits provided
Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Humber, Mersey, Tamar, Tees and Tyne estuaries, England
Metric 5:	Currency	Low	1988 and 1989
Metric 6:	Spatial and Temporal Variability	Medium	samples 1 to 29 collected 20 May to 6 June 1988; samples 30-38 collected between 15 Nov and 3 Dec 1989; about 9 sites. No replicates.
Metric 7:	Exposure Scenario	Medium	concentration in surface waters near the Humber, Mersey, Tamar, Tees, and Tyne estuaries near the North Sea; description of estuaries and setting not provided
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Table 1 provides the concentration in subsurface water by sampling number; no other data/stats provided
Metric 9:	Quality Assurance	Low	QA/QC not directly discussed
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	briefly compared findings to those reported previously. No discussion of variation or limitations.

Overall Quality Determination   Low

Study Citation:	Peterson, J. C., Freeman, D. H. (1984). Variations of phthalate ester concentrations in sediments from the Chester River, Maryland. International Journal of Environmental Analytical Chemistry 18(4):237-252.		
HERO ID:	680376		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Sediment samples along Chester River (fig 1) with a grab sampler in June; brass coring tube through the sampler to obtain core of top 10cm; duplicate cores; stored at 3C before drying.
Metric 2:	Analytical Methodology	Low	Ultrasonic extraction of dried sediment followed by direct analysis of the concentrated crude extract by glass capillary GC-MS; no detection or reporting limits provided.
Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Chester River, Maryland.
Metric 5:	Currency	Low	1978.
Metric 6:	Spatial and Temporal Variability	High	12 sites total; Table II shows n per site; replicate samples; sampled in June only.
Metric 7:	Exposure Scenario	High	concentration of river sediment near a plasticizer-manufacturing plant
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Table II report mean and standard deviation and n per site; sediment concentrations as function of distance from mouth of river plotted in fig 4; fig 6 depicts concentration variation with depth of river sediment. Individual points not reported.
Metric 9:	Quality Assurance	Medium	Recovery >90% (p.240).
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Standard deviation reported in Table II; detailed discussion of variation as a function of distance along river as well as by depth of river. No discussions of limitations.

Overall Quality Determination   **Medium**

Study Citation:	Preston, M. R., Al-Omran, L. A. (1989). Phthalate ester speciation in estuarine water, suspended particulates and sediments. Environmental Pollution 62(2-3):183-194.		
HERO ID:	680380		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	water and sediment samples collected from river bank at three sampling sites (fig 1); water samples collected using apparatus described in earlier paper (Preston, 1986) or by hand; surface sediments collected from two sites (Runcorn and Speke) with a stainless steel spatula ad placed in jars with foil lined caps;
Metric 2:	Analytical Methodology	Low	extracted from the filters in a Soxhlet apparatus; Dissolved phthalates were extracted from water by solvent extractionwith dichloromethane; GC/ECD and GC-MS; limits not reported
Metric 3:	Biomarker Selection	N/A	NA - Water, suspended particles in water, and sediments. No biomarker needed
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	River Mersey Estuary, Liverpool, UK
Metric 5:	Currency	Low	October 1, 1986
Metric 6:	Spatial and Temporal Variability	Low	surface water: 3 sampling sites; 6 samples total; collected on one day (October 1); sediment: 2 sampling sites; unclear if replicate samples
Metric 7:	Exposure Scenario	Medium	setting not described; contamination in river water and sediment
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Table 1 provides dissolved and particulate concentration by sample number; Table 4 shows concentrations in surface sediment
Metric 9:	Quality Assurance	Low	no recoveries; QA/QC not directly discussed
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	compares findings to previous studies

Overall Quality Determination   Low

| Study Citation: | Tan, G. H. (1995). Residue levels of phthalate esters in water and sediment samples from the klang river basin. Bulletin of Environmental Contamination and Toxicology 54(2):171-176. |
| HERO ID: | 680414 |

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	surface water (0.5-1.0 m deep) collected by grab samples from middle of river into glass bottles; sediment samples (0-10cm deep) dug out by excavator and stored in glass bottles; sampling stations (Fig 1); duplicates obtained every 3 months. Missing information on storage.
Metric 2:	Analytical Methodology	High	water extracted with dichloromethane; sediment extracted using Florisil column; recoveries Table 1 and 2; Shimadzu GC 14A chromatograph fitted with a flame ionization detector; detection limits provided on p.175 under Results and Discussion; direct comparison technique using external standards used to identify and quantity the phthalate ester levels in the samples. LOD reported.
Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Klang River, West coast of central Peninsular Malaysia
Metric 5:	Currency	Low	January 1992-February 1993
Metric 6:	Spatial and Temporal Variability	High	12 stations for water; 7 stations for sediment; with average of 4 data sets for each. Duplicates reported.
Metric 7:	Exposure Scenario	High	surface water and sediment from a river seriously affected by pollution, but serves as water supply to two million people; domestic, agricultural and industrial impacts
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Low	Tables 4 and 5 provide the average levels in water and sediment by station. No individual data or summary statistics.
Metric 9:	Quality Assurance	Medium	Tables 1 and 2 show the recovery of phthalates from fortified water and sediment samples. Table 3 shows the blank recoverydata using glass distilled water.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	discusses variability between monitoring stations; compares results to those previously reported. No limitations reported.

Overall Quality Determination   **Medium**

Study Citation:	Vitali, M., Guidotti, M., Macilenti, G., Cremisini, C. (1997). Phthalate esters in freshwaters as markers of contamination sources: A site study in Italy. Environment International 23(3):337-347.		
HERO ID:	680447		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	levels measured in surface water and sediments of rivers and lakes of central Italy (fig 1); collected in 3 series by glass bottles in surficial layer (0-20cm); stored at 4C in dark; sediment collected in stainless steel corer; top 10cm layer, dried, ground to powder, homogenized, and stored at 4C in dark
	Metric 2: Analytical Methodology	High	water samples extracted by liquid/liquid partitioning (EPA methods); 25 g dry weight sediment sonicated for 20 mi with methylene chloride (EPA methods); GC/MS; mean recoveries (Table 1); MDQ and LMD (Table 2)
	Metric 3: Biomarker Selection	N/A	Measured parent chemicals in river water and sediment
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Rieti District, central Italy
	Metric 5: Currency	Low	1994; collected in 3 series
	Metric 6: Spatial and Temporal Variability	Medium	22 sampling points (fig 1); 3 series of water samples for all sampling points (June-July; Aug; and Sept-Oct); sediment samples from 13 points. No replicates
	Metric 7: Exposure Scenario	High	sampling surface water and sediment from rivers and lakes of selected areas impacted by industrial plants, wastewater treatment plants, and cities; sites of different typology (urban, industrial, agricultural, and open country
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Table 3 provides results of the three sampling periods per sampling point. Missing most summary statistics
	Metric 9: Quality Assurance	Medium	mean recoveries and relative std deviation reported in Table 1; results are in good agreement with those reported in the literature and standard methods. Recoveries >70% for all chemicals of interest except in sediments for BBP (65%), but no indication of correction
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	discussed significant problems using sodium sulfate and glass-fiber filters and how treated with organic solvents so no PAEs were detected in procedure blanks; discussed variability between sampling locations and over time; compared findings to previous studies (Table 4). No characterization of variance but raw data are available to calculate

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 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: | Irvin, E., Calafat, A., Silva, M., Aguilar-Villalobos, M., Needham, L., Hall, D., Cassidy, B., Naeher, L. (2010). An estimate of phthalate exposure among pregnant women living in Trujillo, Peru. Chemosphere 80(11):1301-1307. |
| HERO ID: | 697305 |

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	recruitment and sampling described
	Metric 2:	Analytical Methodology	Medium	LOD reported, refers to other publications (Kato et al., 2005; Silva et al.,2007)
	Metric 3:	Biomarker Selection	High	metabolite
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Peru
	Metric 5:	Currency	Low	2004
	Metric 6:	Spatial and Temporal Variability	Medium	79 women, no replicates
	Metric 7:	Exposure Scenario	High	bio monitoring
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	mean, 95% confidence interval
	Metric 9:	Quality Assurance	Medium	Quality control was assured using calibration standards, reagentblanks, and quality control materials of high and low concentrations during each analytical run.
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:	Yan, X., Calafat, A., Lashley, S., Smulian, J., Ananth, C., Barr, D., Silva, M., Ledoux, T., Hore, P., Robson, M. (2009). Phthalates biomarker identification and exposure estimates in a population of pregnant women. Human and Ecological Risk Assessment 15(3):565-578.		
HERO ID:	697308		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	approved by the Institutional Review Board(IRB) at Rutgers University and the Centers for Disease Control and Prevention (CDC).
Metric 2:	Analytical Methodology	Medium	LODs in Table 2, method by David (2000) as expressed by Koch et al. (2003a)
Metric 3:	Biomarker Selection	High	metabolite
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	U.S.
Metric 5:	Currency	Low	published 2009
Metric 6:	Spatial and Temporal Variability	High	150 women, no replicates (sample size varies depending on chemical)
Metric 7:	Exposure Scenario	High	bio monitoring
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	arithmetic mean, SE, median, 95th percentile, range
Metric 9:	Quality Assurance	Medium	Ten percent of all samples collected were quality assurance samples.
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:	Kanazawa, A., Saito, I., Araki, A., Takeda, M., Ma, M., Saijo, Y., Kishi, R. (2010). Association between indoor exposure to semi-volatile organic compounds and building-related symptoms among the occupants of residential dwellings. Indoor Air 20(1):72-84.		
HERO ID:	697390		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methods were described in detail. There is additional follow-up information in Takeda et al., 2009 and Kishi et al., 2009. Air sampling was performed at a height of 1.0–1.5 mfrom a floor and about 1 m from a wall. Dust sampleswere collected using a vacuum cleaner with samples from all over the floor or from multi-surfaces such as tops of doors, shelves, cupboards, and frames.
	Metric 2:	Analytical Methodology	High	Analytical methods were described in the appendix. The method detection limits were included. Details regarding equipment information were included.
	Metric 3:	Biomarker Selection	N/A	Air and dust samples were collected.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Air and dust sampling for SVOC's was conducted inside residential detached houses of Sapporo, Japan.
	Metric 5:	Currency	Medium	Data was collected from October, 2006 through January, 2007.
	Metric 6:	Spatial and Temporal Variability	Medium	There were 40 air samples collected during a 48-hour sampling time, as well as 41 multi-surface dust samples, and 41 floor dust samples collected. A single dust sample was obtained from each dwelling, and replicate sampling was not detailed.
	Metric 7:	Exposure Scenario	Medium	The potential sources of exposures were briefly described in the text, and Table 3 summarized dwelling characteristics such as wall materials, use of flame retardants and dampness. The temperature and humidity microclimate measures within dwellings were summarized. The use of exposure controls was not detailed.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported. Summary statistics were reported in Table 5 with method detection limits and included the median and ranges of measured concentrations along with the number of samples for each chemical.
	Metric 9:	Quality Assurance	Medium	The appendix text noted that quality assurance was described in Saito et al., 2007. The use of travel blanks was detailed within the main text. Recoveries were not detailed and baseline, pre-exposure sampling was not conducted.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study characterizes variability within reported chemical concentration summary statistic ranges. Multiple potential key study limitations were discussed, but are unlikely to have had a substantial impact on results.

Overall Quality Determination   **Medium**

| 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: | Peck, J., Sweeney, A., Symanski, E., Gardiner, J., Silva, M., Calafat, A., Schantz, S. (2010). Intra- and inter-individual variability of urinary phthalate metabolite concentrations in Hmong women of reproductive age. Journal of Exposure Science & Environmental Epidemiology 20(1):90-100. |
| **HERO ID:** | 697726 |

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Cohort substudy. Fox River Environment and Diet Study (FRIENDS) - IRB approved protocol. Briefly described, more information in other references.
	Metric 2:	Analytical Methodology	Medium	Samples sent to CDC Division of Laboratory Sciences for processing and analysis. LOD in text MBzP, 0.11 ug/l; MnBP, 0.4 ug/l; MiBP, 0.26 ug/l; MEHP, 0.9 ug/l;
	Metric 3:	Biomarker Selection	High	metabolite
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	U.S. - Wisconsin
	Metric 5:	Currency	Medium	2005
	Metric 6:	Spatial and Temporal Variability	Medium	n = 45, no replicates
	Metric 7:	Exposure Scenario	High	urine, women of reproductive age
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	mean, SD, 25th, 50th, 75th, 95th, min and max reported; also reported by different demographics
	Metric 9:	Quality Assurance	Medium	Quality control and reagent blank samples were included in each analytical batch along with the study samples.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Measurement variability was assessed using intraclass correlations (ICCs) and surrogate category analysis. Observed a large degree of variability in phthalate metabolite concentrations across all samples

Overall Quality Determination   High

Study Citation:	Lin, S., Ku, H., Su, P., Chen, J., Huang, P., Angerer, J., Wang, S. (2011). Phthalate exposure in pregnant women and their children in central Taiwan. Chemosphere 82(7):947-955.		
HERO ID:	699479		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Most key criteria met, storage duration data lacking.
Metric 2:	Analytical Methodology	Medium	Most key criteria met, LOD's not reported.
Metric 3:	Biomarker Selection	High	Metabolites specific for parent chemicals.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Taiwan
Metric 5:	Currency	Low	Sampling in 2001-2002.
Metric 6:	Spatial and Temporal Variability	Medium	Single samples, but multiple media and sampling at multiple ages for offspring and random selection of participants.
Metric 7:	Exposure Scenario	Medium	Participant characteristics reported.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Most key criteria met, lacking raw data.
Metric 9:	Quality Assurance	Low	Q/A briefly mentioned, most key criteria missing, however training of collection procedures for milk samples.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	Statistical characterization of variability, study limitations not discussed.

Overall Quality Determination   Medium

Study Citation:	Woodruff, T. J., Zota, A. R., Schwartz, J. M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119(6):878-885.		
HERO ID:	755656		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	The articles uses data from the NHANES database, which is a nationally representative survey.
Metric 2:	Analytical Methodology	High	The analysis was conducted using SUDAAN and SAS, with descriptive statistics method referenced.
Metric 3:	Biomarker Selection	High	Biomarkers are known to be related with external exposure.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	The study was conducted in the USA.
Metric 5:	Currency	Medium	NHANES samples were from 2003-2004.
Metric 6:	Spatial and Temporal Variability	Low	1757 total samples from pregnant and nonpregnant women were taken. No replicates were reported.
Metric 7:	Exposure Scenario	Medium	The data represents pregnant women's exposure to chemicals. However, the study doesn't give information about sources.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Only summary statistics reported. Full data can be found on NHANES.
Metric 9:	Quality Assurance	High	NHANES study undergoes QA/QC procedures.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Characterized variability, limited discussion of uncertainties and limitations

Overall Quality Determination   High

| **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	MIPB 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:	Casas, L., Fernández, M. F., Llop, S., Guxens, M., Ballester, F., Olea, N., Irurzun, M. B., Rodríguez, L. S., Riaño, I., Tardón, A., Vrijheid, M., Calafat, A. M., Sunyer, J., INMA Project (2011). Urinary concentrations of phthalates and phenols in a population of Spanish pregnant women and children. Environment International 37(5):858-866.		
HERO ID:	787931		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Urine was collected in 100 mL non-vinyl and nonpolycarbonatecontainers and stored at −20 °C. One aliquot of eachselected individual was shipped to the CDC Environmental HealthLaboratories, and aliquots were stored at or below −20 °C. All urine samples were stored for a minimum of one year and a maximum of 5 years before analysis.
Metric 2:	Analytical Methodology	High	The analytical methodology is described. Table 1. Limits of detection (LOD) for phthalate metabolites and phenols in urine (ng/mL).
Metric 3:	Biomarker Selection	High	Mono-isobutyl phthalate.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Spain.
Metric 5:	Currency	Medium	2004-2008.
Metric 6:	Spatial and Temporal Variability	Medium	No sample replicates. 120 women and 30 children.
Metric 7:	Exposure Scenario	High	Phthalate and phenol exposure is prevalent among the general population and of potential concern for pregnant women and children because of their suspected susceptibility to endocrine effects.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	No individual samples reported. Table 2. Urinary concentrations of phthalate and phenol metabolites (ng/mL) during pregnancyand childhood. Median IQR.
Metric 9:	Quality Assurance	Medium	The only QC reported was the potential cross contamination due to the storage containers.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Uncertainty due to the long storage time and possible cross contamination. Variability reported in summary of statistics (IQR).

Overall Quality Determination   High

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	High	The monoester phthalate is a metabolite of just the chemical of interest.
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	Low	Metabolites not specific to DiBP.
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   Medium

Study Citation:	Blair, J. D., Ikonomou, M. G., Kelly, B. C., Surridge, B., Gobas, F. A. (2009). Ultra-trace determination of phthalate ester metabolites in seawater, sediments, and biota from an urbanized marine inlet by LC/ESI-MS/MS. Environmental Science & Technology 43(16):6262-6268.		
HERO ID:	787951		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Sampling methods, equipment, storage described for each sample type.
	Metric 2: Analytical Methodology	High	Extraction details provided. Method detection limit provided. Instrumentation (GC-MS) and calibration described. Recovery tested.
	Metric 3: Biomarker Selection	Medium	Metabolites measured seawater, sediments, and biota. It is unclear if these are direct metabolites of the parent chemicals of interest.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	British Columbia
	Metric 5: Currency	Medium	2004-2006
	Metric 6: Spatial and Temporal Variability	High	n = 50. Sample duplicates taken.
	Metric 7: Exposure Scenario	Medium	Seawater, marine sediments, invertebrates, and fish directly measured. No information provided on human exposure.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Range of data provided (Table 3), mean GM and SD provided (Figure 2). Individual points not reported.
	Metric 9: Quality Assurance	High	Described in detail. Recovery, calibration, and method Validation described.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Variability in different sample mediums. RED reported. No limitations described.

Overall Quality Determination   High

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:	Lan, Q., Cui, K., Zeng, F., Zhu, F., Liu, H., Chen, H., Ma, Y., Wen, J., Luan, T., Sun, G., Zeng, Z. (2012). Characteristics and assessment of phthalate esters in urban dusts in Guangzhou city, China. Environmental Monitoring and Assessment 184(8):4921-4929.		
HERO ID:	788137		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Most sampling information provided. Missing some pieces like sample equipment
Metric 2:	Analytical Methodology	Low	Detailed extraction methods referenced to another study but LOD/LOQ not provided
Metric 3:	Biomarker Selection	N/A	Measured parent chemicals in urban dust
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Guangzhou, China
Metric 5:	Currency	Medium	Samples collected in 2007
Metric 6:	Spatial and Temporal Variability	Medium	No replicates collected
Metric 7:	Exposure Scenario	Medium	Source of exposure not well characterized
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Raw data not reported
Metric 9:	Quality Assurance	Medium	QA/QC discussed. Recoveries not reported for all individual chemicals.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Some limitations reported

Overall Quality Determination   Medium

Study Citation:	Yolton, K., Xu, Y., Strauss, D., Altaye, M., Calafat, A. M., Khoury, J. (2011). Prenatal exposure to bisphenol A and phthalates and infant neurobehavior. Neurotoxicology and Teratology 33(5):558-566.		
HERO ID:	788169		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Health Outcomes and Measures of the Environment (HOME) Study enrollment criteria and procedures are more completely described elsewhere (Geraghty et al., 2008).
	Metric 2:	Analytical Methodology	Medium	LOD range from 0.3 to 1.2 ng/mL; phthalate metabolites weremeasured at the (CDC) Environmental Health Laboratories using published methods (Silva et al., 2008; Ye et al., 2005).
	Metric 3:	Biomarker Selection	High	metabolite
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	U.S. Ohio
	Metric 5:	Currency	Medium	2003-2006
	Metric 6:	Spatial and Temporal Variability	Medium	n = 332 for week 26, and n = 346 for week 16; no replicates
	Metric 7:	Exposure Scenario	High	urinary samples
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	geometric mean and 95th percentile reported
	Metric 9:	Quality Assurance	Low	QA not discussed, no obvious concerns
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	variability and uncertainty discussed in Limitations section; no obvious concerns

Overall Quality Determination   Medium

Study Citation:	Bergh, C., Torgrip, R., Emenius, G., Ostman, C. (2011). Organophosphate and phthalate esters in air and settled dust - a multi-location indoor study. Indoor Air 21(1):67-76.		
HERO ID:	788335		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	The study discusses all elements of sampling methods. Sampling sites, and air and dust sampling collection are reported.
Metric 2:	Analytical Methodology	Low	The analytical methodology is described, but the LOD or LOQ are not provided.
Metric 3:	Biomarker Selection	N/A	The study tests the parent chemical in environmental media.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Samples were collected at the Stockholm area in Sweden.
Metric 5:	Currency	Low	Sampling date is not reported, the study was published in 2005.
Metric 6:	Spatial and Temporal Variability	High	10 samples were collected per environment.
Metric 7:	Exposure Scenario	High	"Thirty sampling sites (in 10 private homes, 10 workplaces, and 10 daycare centers, all in the Stockholm area) were selected to represent a number of common indoor environments."
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	High	Raw results and summary of data are reported in the supporting information.
Metric 9:	Quality Assurance	Low	There is little discussion but can be implied via the use of standards.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Variability reported in terms of different scenarios. No discussion of uncertainty.

Overall Quality Determination   **Medium**

Study Citation:	Poças, M. F., Oliveira, J. C., Pereira, J. R., Hogg, T. (2010). Consumer exposure to phthalates from paper packaging: an integrated approach. Food Additives & Contaminants: Part A, Chemistry, Analysis, Control, Exposure & Risk Assessment 27(10):1451-1459.		
HERO ID:	788407		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	The sampling methodology is clear and appropriate; however, details such as sampler calibration and sample storage are not provided.
Metric 2:	Analytical Methodology	High	The analytical methodology is clear, detailed, and appropriate; the LOD is provided.
Metric 3:	Biomarker Selection	N/A	Study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Samples were collected in Portugal.
Metric 5:	Currency	Medium	Samples were collected in 2009.
Metric 6:	Spatial and Temporal Variability	High	21 food samples were collected.
Metric 7:	Exposure Scenario	High	The study is testing for phthalates in food and food packaging samples. This scenario is of interest for the chemical and is well characterized.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	High	Raw concentrations are provided in Table 3.
Metric 9:	Quality Assurance	Medium	QA/QC measures are briefly mentioned, including the use of blanks. QA/QC issues were not identified.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	No characterization of variability or uncertainty is provided.

Overall Quality Determination   High

Study Citation:	Mackintosh, C. E., Maldonado, J., Hongwu, J., Hoover, N., Chong, A., Ikonomou, M. G., Gobas, F. A. (2004). Distribution of phthalate esters in a marine aquatic food web: Comparison to polychlorinated biphenyls. Environmental Science & Technology 38(7):2011-2020.		
HERO ID:	789501		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The marine species sampling methodology was described in detail and is scientifically sound.
	Metric 2:	Analytical Methodology	Medium	The analytical methods were described. Recoveries were not reported and the authors indicated that the LOD is in the SI. No information on LOQ is provided.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed marine species' samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Canada
	Metric 5:	Currency	Low	The samples were collected in 1999.
	Metric 6:	Spatial and Temporal Variability	Low	"9 individual samples of 18 marine species [...] Three samples of each species were collected from each of three sampling stations"
	Metric 7:	Exposure Scenario	Low	The data may represent a relevant exposure scenario related to phthalates in marine species in Canada, but the small sample size and missing details about the population of interest limit the results' generalization.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Limited summary statistics were reported.
	Metric 9:	Quality Assurance	Low	QA/QC details were included in the SI.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Limited characterization of variability (SD) and uncertainty.

Overall Quality Determination   **Low**

Study Citation:	Ma, L. L., Chu, S. G., Xu, X. B. (2003). Organic contamination in the greenhouse soils from Beijing suburbs, China. Journal of Environmental Monitoring 5(5):786-790.		
HERO ID:	789556		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Some information missing- such as the exact locations of the 8 samples and details about the coring cylinder.
	Metric 2: Analytical Methodology	Medium	Key analytical methods reported. LOD reported as a range for group of chemical and not individual.
	Metric 3: Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Beijing, China
	Metric 5: Currency	Low	Data collected in 2001
	Metric 6: Spatial and Temporal Variability	High	8 samples; replicates (this indicates at least 16 were taken but there is no exact number described)
	Metric 7: Exposure Scenario	Medium	Soil exposure is a relevant scenario but there is not enough information about the source of the chemicals.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Low	Raw data not provided. Only range and average provided. Little summary statistics provided.
	Metric 9: Quality Assurance	High	QA section describes analysis of blanks and spiked samples. Materials and sample clean up also described in detail.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Gaps and limitations not characterized. Standard deviations provided but there is no additional discussion of variability.

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:	Grigoriadou, A., Schwarzbauer, J., Georgakopoulos, A. (2008). Molecular indicators for pollution source identification in marine and terrestrial water of the industrial area of Kavala City, North Greece. Environmental Pollution 151(1):231-242.		
HERO ID:	792188		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	The study has a clear and appropriate description of sampling methodology.
Metric 2:	Analytical Methodology	High	The study provides detailed description of analytical method and instruments, and states detection limits.
Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical in an environmental media (surface water).
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Kavala, Greece
Metric 5:	Currency	Low	Timing of sample collection for monitoring data is not consistent with when current exposures (2003; >15 years old) may be expected and likely to have a substantial impact on results.
Metric 6:	Spatial and Temporal Variability	High	Eight terrestrial and four marine water samples.
Metric 7:	Exposure Scenario	High	Water samples collected from industrial section of Kavala to determine the occurrence of anthropogenic contaminants.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	The study provides concentrations at each site but summary stats and measure of variation is not provided.
Metric 9:	Quality Assurance	Low	There was no thorough implementation of quality controls.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	There is no discussion of variability, limitations, or uncertainty.

Overall Quality Determination   Medium

Study Citation:	Teitelbaum, S. L., Britton, J. A., Calafat, A. M., Ye, X., Silva, M. J., Reidy, J. A., Galvez, M. P., Brenner, B. L., Wolff, M. S. (2008). Temporal variability in urinary concentrations of phthalate metabolites, phytoestrogens and phenols among minority children in the United States. Environmental Research 106(2):257-269.		
HERO ID:	792230		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	epi enrollment and sampling described. Study was approved by the Institutional Review Boards of Mount Sinai School of Medicine and the CDC. Limited discussion on collection of urine sample. No description of sampling containers or sampling time of day
Metric 2:	Analytical Methodology	High	LOD in table 1. Samples were analyzed at the National Center for Environmental Health of the Centers for Disease Control and Prevention (CDC). CDC laboratory is certified by the Health Care Financing Administration
Metric 3:	Biomarker Selection	High	metabolite
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	U.S. NYC
Metric 5:	Currency	Low	2004
Metric 6:	Spatial and Temporal Variability	Medium	n = 29 children, n=153 samples, no replicates
Metric 7:	Exposure Scenario	High	urine, human biomonitoring
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	tertiles provided
Metric 9:	Quality Assurance	Medium	all analytical methods, standard quality control (QC) and reagent blank samples were included in each analytical batch along with the unknown samples. No sampling controls included to address possible phthalate contamination of sampling equipment
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	temporal variability discussed

Overall Quality Determination   Medium

Study Citation:	Langer, S., Weschler, C. J., Fischer, A., Bekö, G., Toftum, J., Clausen, G. (2010). Phthalate and PAH concentrations in dust collected from Danish homes and daycare centers. Atmospheric Environment 44(19):2294-2301.		
HERO ID:	1007791		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Sampling procedure, equipment, matrix characters are clearly described and detailed description was provided in the supplementary materials.
Metric 2:	Analytical Methodology	High	GC/MS was used to analyze the dust samples and recoveries were reported. LOQs were reported in Table S1.
Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Odense, Denmark
Metric 5:	Currency	Medium	The dust samples were collected in 2008.
Metric 6:	Spatial and Temporal Variability	High	The study has large sample size and can capture the variability of environmental contamination in population and scenario.
Metric 7:	Exposure Scenario	Medium	The data likely represent the relevant exposure scenario.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Supplementary or raw data or individual data points are not reported.
Metric 9:	Quality Assurance	High	Quality assurance was conducted. Recoveries for samples were reported and all above 90%.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	The study has a robust comparison to other publications and discussion of limitations. It provides evidence for the consistency of the data.

Overall Quality Determination   High

Study Citation:		Wang, G., Kawamura, K., Lee, S., Ho, K., Cao, J. (2006). Molecular, seasonal, and spatial distributions of organic aerosols from fourteen Chinese cities. Environmental Science & Technology 40(15):4619-4625.	
HERO ID:		1229018	

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology is scientifically sound and comprehensive. Site, equipment, storage, and methods described. Missing instrument calibration.
	Metric 2:	Analytical Methodology	Low	LOQ, LOD not reported. Extraction methods and analytical instrument described (GC-MS). Missing instrument calibration. Recovery samples reported.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental sample.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China.
	Metric 5:	Currency	Low	Samples from 2003
	Metric 6:	Spatial and Temporal Variability	Medium	Two 24 h samples in each city (14) in two seasons. 56 samples in total. No replicates.
	Metric 7:	Exposure Scenario	Medium	Likely to represent exposure scenario but there isn't sufficient description about population that would be exposed.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual data points are provided in SI. Average concentrations reported but little summary statistics.
	Metric 9:	Quality Assurance	Medium	QA/QC was conducted but lacks thorough description. Average recoveries of all the standards were better than 80%. Collected field blanks.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variation in cities and seasons analyzed. SD reported in article and S1. No discussion of uncertainties, limitations or data gaps.

Overall Quality Determination   Medium

Study Citation:	Schlumpf, M., Kypke, K., Wittassek, M., Angerer, J., Mascher, H., Mascher, D., Vökt, C., Birchler, M., Lichtensteiger, W. (2010). Exposure patterns of UV filters, fragrances, parabens, phthalates, organochlor pesticides, PBDEs, and PCBs in human milk: correlation of UV filters with use of cosmetics. Chemosphere 81(10):1171-1183.		
HERO ID:	1249442		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology discussed extensively in terms of sampling equipment, procedures, storage, and study site (participants' homes). Insufficient information on duration of sample storage time prior to sample analysis.
	Metric 2:	Analytical Methodology	Medium	Extraction methodology, analytical instrumentation (phthalates: LC/LC-MS/MS), and LOD only as a range for phthalates. Analytic methods noted as following modified referenced procedures. Insufficient information on instrument calibration, recovery rates for chemicals of interest.
	Metric 3:	Biomarker Selection	High	Sampling for metabolite of chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Switzerland
	Metric 5:	Currency	Medium	Phthalates sampling in 2006.
	Metric 6:	Spatial and Temporal Variability	Medium	Daily breast milk samples pooled and analyzed for n=20 samples for DEHP, BBP, DBP, and DIBP, n=6 DINP samples, however non-statistical sampling approach.
	Metric 7:	Exposure Scenario	Medium	Breast milk samples from women with insufficient information on profession/occupation (although present and past profession data collected within survey, authors noted it as not sufficiently detailed for use within analysis). Lack of field blank/exposure controls.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Breast milk sample lipid-adjusted concentration summary statistics reported as means with SD, median, 95th percentile, and range for year of sampling with number of samples analyzed and number of positive detected samples. Location of sampling described as at home of participant. Insufficient information on raw data sampling results.
	Metric 9:	Quality Assurance	Medium	Quality assurance measures in sampling procedures described in terms of trained personnel assistance in breast milk sampling, training of mothers in procedures and adherence to procedures insuring lack of sample contamination. Insufficient information on correction for blank concentrations, lack of baseline/pre-exposure sampling.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Sampling variability characterized and ranges of exposures for each chemical presented. Authors note most reported concentrations similar compared to previous European publications, however discussion of study limitations/uncertainties lacking.

Overall Quality Determination   Medium

| Study Citation: | Bergh, C., Aberg, K. M., Svartengren, M., Emenius, G., Oestman, C. (2011). Organophosphate and phthalate esters in indoor air: a comparison between multi-storey buildings with high and low prevalence of sick building symptoms. Journal of Environmental Monitoring 13(7 (Jul 2011)):2001-2009. |
| HERO ID: | 1249459 |

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Sampling methodology for indoor air was sound and sufficiently detailed. Duration of sample storage was not detailed.
Metric 2:	Analytical Methodology	High	Analytical methodology was sound and sufficiently detailed. Method detection limits were reported within Table 2.
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	This study collected indoor air samples within multistory buildings in Stockholm, Sweden participating in the Healthy Sustainable Houses study in Stockholm (3H).
Metric 5:	Currency	Low	Sample collection dates were not provided, however study publication date was 2011.
Metric 6:	Spatial and Temporal Variability	High	Duplicate 24-hour active air samples were collected from two to four apartments (a total of 169 apartments) in each of 45 multistory buildings.
Metric 7:	Exposure Scenario	High	The exposure scenario was well characterized within this study of indoor air within apartments of multistory buildings. Identification of the potential sources of indoor air contaminants was one of the study's main objectives, and a robust discussion of potential sources was presented.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Raw data and detection frequency was not presented. Summary statistics were presented and included mean, median and minimum and maximum concentration levels.
Metric 9:	Quality Assurance	Medium	Quality assurance (QA) methods, such as replicate sampling and use of field blanks, were reported and although QA details were not reported in detail, standard procedures were followed. Authors referenced another study for additional sampling and analytic details (C. Bergh, R. Torgrip and C. € Ostman, Rapid Commun. MassSpectrom., 2010, 24, 2859–2867).
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Variability was described in sampling summary statistics. Median concentration levels were compared with results from previous studies within tables, however a robust discussion of potential study limitations is lacking.

Overall Quality Determination   **Medium**

Study Citation:		Björklund, K., Strömvall, A. M., Malmqvist, P. A. (2011). Screening of organic contaminants in urban snow. Water Science and Technology 64(1):206-213.		
HERO ID:		1249477		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Collected roadside snow few days after snowfall at 3 sites (Karra, Garda, Jarnbrott) and sample snow 3 deposits (Gardamotet, Heden, Valhamra) at end of winter (Table 1); urban background sample collected in Delsjon forest area; collected in glass containers or stainless-steel containers; thawed at room temp before extraction.
	Metric 2:	Analytical Methodology	Low	LL extracted with n-hexane; GC-MS; DL 0.1-2.0 ug/L; recoveries not mentioned. LOD not reported.
	Metric 3:	Biomarker Selection	N/A	Parent compound in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Gothenburg, Sweden.
	Metric 5:	Currency	Medium	2009 and 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	11 samples; samples 2/5/2009 and 1/26, 3/5, 3/30 2010 (Table 1); not clear if replicate samples were taken at same time
	Metric 7:	Exposure Scenario	High	Contamination in urban snow.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Fig 2d shows concentration by sampling site and date; DF, ranges, max provided in text p.211- hard to see values. Individual data not reported, little summary statistics.
	Metric 9:	Quality Assurance	Medium	No individual QC section. No recoveries mentioned; procedural blanks used.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Discussed variability between sites and time; compared results to other studies. Some limitations discussed.

Overall Quality Determination   **Medium**

Study Citation: Reyes-Contreras, C., Matamoros, V., Ruiz, I., Soto, M., Bayona, J. M. (2011). Evaluation of PPCPs removal in a combined anaerobic digester-constructed wetland pilot plant treating urban wastewater. Chemosphere 84(9):1200-1207.

HERO ID: 1249709

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Methodology description is brief. No mention of how sampling equipment was cleaned before sampling.
	Metric 2:	Analytical Methodology	High	GC-MS method described and LOD provided.
	Metric 3:	Biomarker Selection	N/A	Chemical measured in wastewater
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Galicia, Spain
	Metric 5:	Currency	Medium	2008-2009
	Metric 6:	Spatial and Temporal Variability	Medium	24 water samples collected for each campaign. 3 sludge samples per campaign. No indication of replicate sampling or analysis.
	Metric 7:	Exposure Scenario	Medium	Sampling was at experimental pilot plant and potential exposure scenario did not seem directly relevant to a population.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data provided. Summary statistics used for presenting results.
	Metric 9:	Quality Assurance	Low	Very little description of QA/QC methods. Surrogate spiking and recovery mentioned but numbers not reported. Procedural blanks briefly mentioned but other controls were not clear.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Little discussion of variability of results and limitations of study.

Overall Quality Determination   Medium

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

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

Overall Quality Determination   High

Study Citation:	Teitelbaum, S. L., Mervish, N., Moshier, E. L., Vangeepuram, N., Galvez, M. P., Calafat, A. M., Silva, M. J., Brenner, B. L., Wolff, M. S. (2012). Associations between phthalate metabolite urinary concentrations and body size measures in New York City children. Environmental Research 112:186-193.
HERO ID:	1249979

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	IRB from Mount Sinai School of Medicine and CDC.
	Metric 2:	Analytical Methodology	Low	CDC laboratory is certified by the Health Care Financing Administration. LOD not provided.
	Metric 3:	Biomarker Selection	High	metabolites
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	U.S.
	Metric 5:	Currency	Medium	2004-2007
	Metric 6:	Spatial and Temporal Variability	Medium	girls n=299; boys n=80, no replicates
	Metric 7:	Exposure Scenario	High	urine
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	median provided
	Metric 9:	Quality Assurance	Medium	Quality control samples were evaluated according to standard statistical probability rules (www.westgard.com).
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:	Gu, Z., Feng, J., Han, W., Wu, M., Fu, J., Sheng, G. (2010). Characteristics of organic matter in PM2.5 from an e-waste dismantling area in Taizhou, China. Chemosphere 80(7):800-806.		
HERO ID:	1256038		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Scientifically sound, well described methods. Some information missing such as instrument calibration.
Metric 2:	Analytical Methodology	Low	Analytical methods described. Missing LOQ/LOD
Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Taizhou, China
Metric 5:	Currency	Medium	Samples collected in 2006 and 2007
Metric 6:	Spatial and Temporal Variability	Medium	6-7 samples per scenario, in duplicates
Metric 7:	Exposure Scenario	High	Source of exposure is identified, microenvironment is described
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Raw data not provided, only summary statistics
Metric 9:	Quality Assurance	High	QA details are provided e.g. field and lab control samples.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Key uncertainties, limitations and data gaps not discussed. Seasonal variability and types of waste analyzed.

Overall Quality Determination   Medium

Study Citation: SUNY, (2009). Concentration of phthalate in dorm rooms and its association with asthma and allergy. 2:1012-1020.
HERO ID: 1312101

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methodology briefly described and appropriate, missing information on blanks, and cross contamination care during sample
	Metric 2:	Analytical Methodology	Low	very limited description, no limits of detection, QC, blanks, recoveries
	Metric 3:	Biomarker Selection	N/A	Dust samples, biomarker not needed.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	Medium	2007
	Metric 6:	Spatial and Temporal Variability	High	175 dust samples
	Metric 7:	Exposure Scenario	High	College dorms
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Some stats in Figure 1 and Table 2 median
	Metric 9:	Quality Assurance	Low	Analytical not described or reported, did have sampling controls, but unknown how these were collected and assessed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	some discussion on the variability, but without the QC and details of sampling is tough to know if discussion is correct

Overall Quality Determination   Low

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

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

Overall Quality Determination   Uninformative

Domain		Metric	Rating	Comments
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 51:1-7.		
HERO ID:		1332529		
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:	Peterson, J. C., Freeman, D. H. (1982). Phthalate ester concentration variations in dated sediment cores from the Chesapeake Bay, USA. Environmental Science & Technology 16(8):464-469.		
HERO ID:	1335216		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling method, equipment, and site described, map included. Some information missing, such as storage and equipment calibration.
	Metric 2:	Analytical Methodology	Low	LOD not reported; "detailed description of extraction and analysis procedure is in preparation and will be published elsewhere."
	Metric 3:	Biomarker Selection	N/A	sediment
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	U.S.
	Metric 5:	Currency	Low	1979
	Metric 6:	Spatial and Temporal Variability	High	2 sites- 10-12 depth samples per site, replicates done.
	Metric 7:	Exposure Scenario	Low	sediment core samples- little information given for exposure scenarios
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1 raw data. Some summary statistics reported.
	Metric 9:	Quality Assurance	Medium	QA not discussed, no obvious concerns- recoveries and blanks reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability in sediment depth and time analyzed. Limitations not discussed.

Overall Quality Determination   Medium

Study Citation:	Koch, H. M., Lorber, M., Christensen, K. L. Y., Pälmke, C., Koslitz, S., Brüning, T. (2013). Identifying sources of phthalate exposure with human biomonitoring: Results of a 48h fasting study with urine collection and personal activity patterns. International Journal of Hygiene and Environmental Health 216(6):672-681.		
HERO ID:	1464613		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Each participant collected all urine voids over a 48-hr fasting period. Each void stored separately, frozen at -18 °C; collection bags phthalate free. Also pre- and post-fast voids collected. Creatine adjusted.
Metric 2:	Analytical Methodology	Medium	Deconjugated, internal isotope standards, and LC/LC-MS/MS using methods of Koch et al. (2003, 2007) and Preuss et al. (2005). LOD and LOQ reported. Instrument calibration missing but may be detailed in the methods referenced in the previous sentence.
Metric 3:	Biomarker Selection	High	Table 1 lists parent chemicals and their metabolites. Four metabolites of DEHP analyzed in urine: MEHP, MECPP, MEOHP, and MEHHP. It seems like the study is measuring each metabolite from the chemicals of interest.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Germany, Bochum.
Metric 5:	Currency	Medium	2009.
Metric 6:	Spatial and Temporal Variability	Medium	Five adults (2 male, 3 female) participated. All urine voided over 48-hr fasting period collected. No replicates.
Metric 7:	Exposure Scenario	High	Study to examine exposure via medications and personal care products without contribution of foods or beverages to phthalate exposure. No known occupational exposures.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	High	Reported mean, (SD), median, and 95th percentile values as well as detection frequency (Table 2). Metabolite concentrations normalized to creatinine. Raw data by individual subject presented graphically in Supplemental materials.
Metric 9:	Quality Assurance	High	Quality control, prepared from pooled native urine, and reagent blank samples included in each analytic batch. The lab participated in the EU Consortium to Perform Human Biomonitoring on a European Scale (COPHES). Creatinine concentrations measured by Jaffe method.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Supplemental materials show individual variation in pattern of metabolite concentrations for each urine void collected over 48-hr period (and pre and post). Discussed uncertainties and variability in results relative to other studies and to daily diaries of product use. SD reported.

Overall Quality Determination   High

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

HERO ID: 1588869

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

Overall Quality Determination High

Study Citation:	Frederiksen, H., Nielsen, J. K., Mørck, T. A., Hansen, P. W., Jensen, J. F., Nielsen, O., Andersson, A. M., Knudsen, L. E. (2013). Urinary excretion of phthalate metabolites, phenols and parabens in rural and urban Danish mother-child pairs. International Journal of Hygiene and Environmental Health 216(6):772-783.		
HERO ID:	1588874		

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	High	Key criteria met.
	Metric 3: Biomarker Selection	High	Metabolites specific for parent chemicals.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Denmark.
	Metric 5: Currency	Medium	Sampling 2011.
	Metric 6: Spatial and Temporal Variability	Medium	145 participants, single first morning urine samples, urban and rural.
	Metric 7: Exposure Scenario	High	Participant demographic characteristics reported.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Most key criteria met. Lack of raw data.
	Metric 9: Quality Assurance	High	Key criteria met.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Low	Statistical variability reported within summary measures, lacking robust discussion of potential study limitations.

Overall Quality Determination **High**

Domain		Metric	Rating	Comments
Study Citation:		Enke, U., Schleussner, E., Pälmke, 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 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 MiBP
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:	Wan, H. T., Leung, P. Y., Zhao, Y. G., Wei, X., Wong, M. H., Wong, C. K. (2013). Blood plasma concentrations of endocrine disrupting chemicals in Hong Kong populations. Journal of Hazardous Materials 261:763-769.		
HERO ID:	1597652		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Sampling method and storage described. Missing other information on equipment and procedures/regime
	Metric 2: Analytical Methodology	Medium	LOD and LOQ range provided; equipment and extraction described
	Metric 3: Biomarker Selection	N/A	Tested for parent chemicals in plasma, not metabolites or other biomarkers
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Hong Kong
	Metric 5: Currency	Medium	2010-2011
	Metric 6: Spatial and Temporal Variability	Medium	153 blood samples, no replicates
	Metric 7: Exposure Scenario	High	Study described possible exposure sources. It tested parent chemicals in plasma, so people were already exposed
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	mean, SD, median, min, max, and % of samples below LOD provided. No replicates
	Metric 9: Quality Assurance	High	Blanks, standards, and recoveries were described. Recovery percentages were acceptable.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Variability captured with SD, min and max. Limited discussion of uncertainties and gaps

Overall Quality Determination   Medium

Study Citation:	Beko, G., Weschler, C. J., Langer, S., Callesen, M., Toftum, J., Clausen, G.,eo (2013). Children's phthalate intakes and resultant cumulative exposures estimated from urine compared with estimates from dust ingestion, inhalation and dermal absorption in their homes and daycare centers. PLoS ONE 8(4):e62442.		
HERO ID:	1597735		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	The study described the sampling procedure for dust and urinary sample. Urinary concentration sampling were briefly described in the present study. Storage conditions were described. All pertinent sampling information for indoor dust is provided in the supplementary information in another study of the same cohort, Langer et al., 2010(HERO ID: 1007791).
	Metric 2: Analytical Methodology	High	Analytical methods for both urinary concentrations (LC/MS) and dust concentrations (GC-MS) were provided. Detection limits were reported. (Dust - Langer et al., 2010 supp table S1 HERO ID: 1007791; Urinary - Langer et al., 2013 table 1 HERO ID: 600114).
	Metric 3: Biomarker Selection	High	Biomarker (parent chemical or metabolite) is derived from exposure to the chemical of interest.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Odense, Denmark
	Metric 5: Currency	Medium	The dust samples and urinary samples were collected in 2008.
	Metric 6: Spatial and Temporal Variability	High	The study has large sample size and can capture the variability of environmental contamination in population and scenario.
	Metric 7: Exposure Scenario	Medium	The data likely represent the relevant exposure scenario.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Supplementary or raw data or individual data points are not reported.
	Metric 9: Quality Assurance	High	Quality assurance was conducted for both dust concentration and urinary concentration. Recoveries for urinary concentrations were provided in Langer et al 2013 (1600114). Recoveries for dust concentrations were reported in Langer et al 2010 (1007791).
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	High	The study has a robust comparison to other publications and discussion of limitations. It provides evidence for the consistency of the data.

Overall Quality Determination ············ **High**

Study Citation:	Llompart, M., Sanchez-Prado, L., Pablo Lamas, J., Garcia-Jares, C., Roca, E., Dagnac, T. (2013). Hazardous organic chemicals in rubber recycled tire playgrounds and pavers. Chemosphere 90(2):423-431.		
HERO ID:	1597738		

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	N/A.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Spain.
	Metric 5: Currency	Medium	Study published in 2013.
	Metric 6: Spatial and Temporal Variability	Medium	9 to 21 samples, no replicates.
	Metric 7: Exposure Scenario	High	Exposure source well characterized.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Raw data not provided, stats in Table 2, analytical summary in Table 1.
	Metric 9: Quality Assurance	Medium	QA factors implied and summarize in Table 1.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Limited gaps and limitations reported.

Overall Quality Determination   High

Study Citation:	Mortamais, M., Chevrier, C., Philippat, C., Petit, C., Calafat, A. M., Ye, X., Silva, M. J., Brambilla, C., Eijkemans, M. J., Charles, M. A., Cordier, S., Slama, R. (2012). Correcting for the influence of sampling conditions on biomarkers of exposure to phenols and phthalates: a 2-step standardization method based on regression residuals. Environmental Health 11(1):29.		
HERO ID:	1597770		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	This paper is about sampling. Methods were well-characterized. They describe a 2-step standardization method to limit the impact of between-subject variations in sampling conditions.
	Metric 2: Analytical Methodology	Medium	LODs would be found in the second SI file. Samples were sent to the National Center for Environmental Health laboratory at the Centers for Disease Control and Prevention in the US for analysis a few years after collection. Analytical methods are summarized.
	Metric 3: Biomarker Selection	High	Metabolites were measured in urine. 4 metabolites of DEHP were summed. 7 other metabolites were reported individually. The metabolites of this chemical have a direct and known relationship with the parent chemical.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	France
	Metric 5: Currency	Medium	2002-2006
	Metric 6: Spatial and Temporal Variability	Medium	287 samples were collected, but no replicates. Urine samples were collected in the morning.
	Metric 7: Exposure Scenario	Medium	Samples reflect amount of phthalate metabolites in urine of pregnant women in the vicinity of 3 cities in France. The questionnaire the women completed did not go into detail about potential sources of exposure to phthalates, but information such as whether the women smoked was collected.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Median values and the 25th and 75th percentiles were provided, but not means, ranges, or standard deviations. Raw data was not included. This article shows only a subset of the data collected. For more detailed results, see Chevrier C, Petit C, Philippat C, Mortamais M, Slama R, Rouget F, Calafat AM, Ye X, Silva MJ, Charles MA, et al: Maternal Urinary Phthalates and Phenols and Male Genital Anomalies. Epidemiology 2012, 23(2):353–356.
	Metric 9: Quality Assurance	Low	QA was not discussed, but no obvious concerns came to mind during review.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Some limitations are discussed, e.g., possible factors not characterized that could have affected results. One data table provides information about the association between sampling conditions (time, season, gestational age, duration of sample storage at room temperature, etc.) and concentrations of log-transformed phthalate metabolites. These are the only elements pf the paper that address variability and uncertainty.

Overall Quality Determination   **Medium**

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

Domain	Metric	Rating	Comments
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:	Langer, S., Bekö, G., Weschler, C. J., Brive, L. M., Toftum, J., Callesen, M., Clausen, G. (2014). Phthalate metabolites in urine samples from Danish children and correlations with phthalates in dust samples from their homes and daycare centers. International Journal of Hygiene and Environmental Health 217(1):78-87.		
HERO ID:	1600114		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Sampling procedure, equipment, matrix characters, calibration are clearly described and detailed description was provided in the main text.
	Metric 2: Analytical Methodology	High	Analytical methods for both urinary concentrations (LC/MS) and dust concentrations (GC-MS) were provided. Detection limits were reported. (Dust concentrations provided in Langer et al., 2010 Table S1; HERO ID is 1007791. Urinary results presented in Table 1 of this study). Authors did not adjust for creatinine but explained why.
	Metric 3: Biomarker Selection	Low	MiBP is not specific to DIBP.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Study was performed in Odense, Denmark.
	Metric 5: Currency	Medium	The dust samples and urinary samples were collected in 2008.
	Metric 6: Spatial and Temporal Variability	Medium	The study has large sample size and can capture the variability of environmental contamination in population and scenario. There were no replicates, which might not be appropriate for a large study analyzing urine samples, but monitoring guide instructs that medium is the highest score if replicates are missing.
	Metric 7: Exposure Scenario	High	The study explained the many possible sources of exposure to phthalates and their population of interest. This is a biomonitoring study to assess exposure to the chemicals.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Supplementary or raw data or individual data points are not reported.
	Metric 9: Quality Assurance	High	Quality assurance was conducted for both dust concentration and urinary concentration. Recoveries for urinary concentrations were provided in this study. Recoveries for dust concentrations were reported in another study Langer et al 2010 (HERO ID: 1007791).
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	The study has a robust characterization of variance with standard deviations for both the geometric and arithmetic means, as well as percentiles. There is some discussion of uncertainties, limitations, and gaps.

Overall Quality Determination   **High**

Study Citation:	Téllez-Rojo, M. M., Cantoral, A., Cantonwine, D. E., Schnaas, L., Peterson, K., Hu, H., Meeker, J. D. (2013). Prenatal urinary phthalate metabolites levels and neurodevelopment in children at two and three years of age. Science of the Total Environment 461-462:386–390.		
HERO ID:	1639217		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Sample collection procedure was reported with details; standard method to measure human urinary concentration was used.
Metric 2:	Analytical Methodology	High	Analytical process was reported. LOD for each metabolite was reported in Table 2.
Metric 3:	Biomarker Selection	High	Biomarker (parent chemical or metabolite) is derived from exposure to the chemical of interest.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Mexico City
Metric 5:	Currency	Low	Samples were archived urine samples from 1997-2003
Metric 6:	Spatial and Temporal Variability	Medium	Final sample consisted of 135 children. No indication of replicate sampling or analysis.
Metric 7:	Exposure Scenario	High	Exposure matrix was highly relevant - metabolite of target chemicals.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Geometric mean were reported, no raw data were provided.
Metric 9:	Quality Assurance	Medium	QA/QC was conducted but briefly discussed.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	The study has a robust discussion of its limitations and comparisons to other publications.

Overall Quality Determination   High

| | Study Citation: | Hongjun, Y., Wenjun, X., Qing, L., Jingtao, L., Hongwen, Y., Zhaohua, L. (2013). Distribution of phthalate esters in topsoil: a case study in the Yellow River Delta, China. Environmental Monitoring and Assessment 185(10):8489-8500. |
| | HERO ID: | 1639226 |

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	Yellow River Delta, China
	Metric 5:	Currency	Medium	Samples collected in September 2009
	Metric 6:	Spatial and Temporal Variability	Medium	>10 samples; no replicates
	Metric 7:	Exposure Scenario	Medium	Soil samples in various locations, urban, suburban and rural. Unclear if is applicable to US soils
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported
	Metric 9:	Quality Assurance	High	QA reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Gaps and limitations not well characterized

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

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

Overall Quality Determination   Uninformative

Study Citation:	Dirtu, A. C., Geens, T., Dirinck, E., Malarvannan, G., Neels, H., Van Gaal, L., Jorens, P. G., Covaci, A. (2013). Phthalate metabolites in obese individuals undergoing weight loss: Urinary levels and estimation of the phthalates daily intake. Environment International 59(Elsevier):344–353.		
HERO ID:	1936010		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	ENDORUP trial described, 24-hour urine at 4 timepoints described. Some information missing such as sampling equipment and storage.
Metric 2:	Analytical Methodology	High	LOQ in Table SI.3. Equipment and extraction described. Calibration described in SI. Creatinine adjusted.
Metric 3:	Biomarker Selection	High	Metabolite in urine. The study indicates that the metabolites are from the parent chemicals of interest.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Belgium
Metric 5:	Currency	Medium	2009-2012
Metric 6:	Spatial and Temporal Variability	High	152 participants, 24-hour urine samples. Blind sample duplicates (at least 2 blind duplicate samples per batch of 20 samples)
Metric 7:	Exposure Scenario	High	Biomonitoring in humans, more specifically obese individuals.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Summary statistics provided, including median, 10th, 90th, 25th, 75th. Individual points not reported.
Metric 9:	Quality Assurance	High	LOQ, spike level, recovery, method precision, blind duplicate samples, internal blanks described; also participated in inter-laboratory comparison exercise GERMAN EQUAS 2012.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Variability discussed and compared to other studies. No limitations reported.

Overall Quality Determination   High

Study Citation:	Upson, K., Sathyanarayana, S., De Roos, A. J., Thompson, M. L., Scholes, D., Dills, R., Holt, V. L. (2013). Phthalates and risk of endometriosis. Environmental Research 126:91-97.		
HERO ID:	1936011		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	WREN study enrollment described and refers to other papers; Non-fasting spot urine samples
	Metric 2: Analytical Methodology	High	LOQ, extraction, and equipment described
	Metric 3: Biomarker Selection	High	metabolite in urine
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	U.S.
	Metric 5: Currency	Low	1996-2001
	Metric 6: Spatial and Temporal Variability	Medium	n = 92 cases and n = 195 controls, no replicates
	Metric 7: Exposure Scenario	High	urine
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	median and IQR provided
	Metric 9: Quality Assurance	Medium	quality process described; inter batch reliability reported
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	variability and uncertainty not discussed, no obvious concerns

Overall Quality Determination   High

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 $\geq$ 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:	Lewis, R. C., Meeker, J. D., Peterson, K. E., Lee, J. M., Pace, G. G., Cantoral, A., Téllez-Rojo, M. M. (2013). Predictors of urinary bisphenol A and phthalate metabolite concentrations in Mexican children. Chemosphere 93(10):2390-2398.		
HERO ID:	2000737		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Low	ELEMENT cohort described; urine sampling not described in detail.
Metric 2:	Analytical Methodology	Medium	An in-house method was developed, which was a slight modification of the CDC Laboratory Procedure Manuals for phthalate metabolites in urine (method no. 6306.03, revised: July 3, 2010) - modification not described; LOQ provided
Metric 3:	Biomarker Selection	High	The study is looking at parent chemical/metabolites in urine.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Study was conducted among children/mothers in Mexico.
Metric 5:	Currency	Medium	Timing of sample collection for monitoring data is less consistent with current or recent exposures may be expected (.5 yrs). Sampling period was from 2010. However some prior data from a 1994 cohort study was also used.
Metric 6:	Spatial and Temporal Variability	Low	The study used a large sample size (n = 49 boys and 50 girls). However, urine sampling not described well enough (the study is not clear if urine samples were 24 hrs samples collected vs. first morning).
Metric 7:	Exposure Scenario	High	Biomonitoring to quantify the exposure from Mexican boys and girls from the ELEMENT cohort.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Supplementary or raw data (i.e., individual data points) are not reported , and therefore summary statistics cannot be reproduced.Geometric mean, 10th, 25th, 50th, 75th, 90th, 95th, max provided.
Metric 9:	Quality Assurance	Low	Quality control samples mentioned. However, no other details provided.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Variability reported as percentiles. Some uncertainties have been identified, but are unlikely to have a substantial impact on results.

Overall Quality Determination   Medium

Study Citation: Kim, M., Song, N. R., Choi, J. H., Lee, J., Pyo, H. (2014). Simultaneous analysis of urinary phthalate metabolites of residents in Korea using isotope dilution gas chromatography-mass spectrometry. Science of the Total Environment 470-471:1408-1413.

HERO ID: 2000812

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Critically Deficient	The sampling methodology is not discussed. The only information that is given is "Twelve-hour urine samples were collected by the Korea Food and Drug Administration (KFDA) through local health departments on May 2011. One hundred eleven samples were collected from adults in urban (Seoul) and rural (Chuncheon) regions"
	Metric 2: Analytical Methodology	Medium	LOD; some extraction and equipment description
	Metric 3: Biomarker Selection	High	metabolite in urine
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Korea
	Metric 5: Currency	Medium	2011
	Metric 6: Spatial and Temporal Variability	Low	n = 5, no replicates, urine sampling not described
	Metric 7: Exposure Scenario	Low	urine
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	mean, range, and frequency
	Metric 9: Quality Assurance	Medium	recovery and precision discussed
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:	Yoshida, T., Matsunaga, I. (2006). A case study on identification of airborne organic compounds and time courses of their concentrations in the cabin of a new car for private use. Environment International 32(1):58-79.		
HERO ID:	2095300		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Sampling methods described for all air pollutants of interest.
	Metric 2: Analytical Methodology	Low	LOD not reported
	Metric 3: Biomarker Selection	N/A	Air sampling
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Cars in Osaka, Japan
	Metric 5: Currency	Low	Data collected in 1999
	Metric 6: Spatial and Temporal Variability	Medium	Sampling done 44 times during time period. No indication of replicate sampling for all samples or replicate analysis.
	Metric 7: Exposure Scenario	High	Car interior
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Note raw data reported in a figure so will be difficult to extract
	Metric 9: Quality Assurance	Low	QA/QC not explicitly described. Detection limits for instruments and recovery not measured.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	No limitations nor gaps reported

Overall Quality Determination   Medium

Study Citation: Shen, L., Xia, B., Dai, X. (2013). Residues of persistent organic pollutants in frequently-consumed vegetables and assessment of human health risk based on consumption of vegetables in Huizhou, South China. Chemosphere 93(10):2254-2263.

HERO ID: 2149595

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods described.
	Metric 2:	Analytical Methodology	Low	LOD not reported and missing QA/QC.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	Low	Sampling date not reported, published in 2013.
	Metric 6:	Spatial and Temporal Variability	High	17 types of vegetables each with >10 samples.
	Metric 7:	Exposure Scenario	Medium	Consumption of vegetables and questionnaire.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Critically Deficient	No specific chemical concentrations reported.
	Metric 9:	Quality Assurance	Low	Missing QA/QC discussion, included calibration range.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Discussed distribution and differences between women and men and other studies.

Overall Quality Determination   Uninformative

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

Domain	Metric	Rating	Comments
Study Citation:	Mackintosh, C. E., Maldonado, J. A., Ikonomou, M. G., Gobas, F. A. (2006). Sorption of phthalate esters and PCBs in a marine ecosystem. Environmental Science & Technology 40(11):3481-3488.		
HERO ID:	2158899		

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Well described, scientifically sound methodology
	Metric 2:	Analytical Methodology	High	Thorough description, reports LODs. Values in Supporting Information.
	Metric 3:	Biomarker Selection	N/A	Water and sediment sample
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Canada
	Metric 5:	Currency	Low	Published in 2006. No sampling date
	Metric 6:	Spatial and Temporal Variability	Medium	4 sampling locations with replicates for total of 12 water samples in total, 17 sediment samples in total
	Metric 7:	Exposure Scenario	High	describes sampling location as former industrial site that now hosts public market, docks, public entertainment venue.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Does not report raw data, only summary statistics
	Metric 9:	Quality Assurance	High	Used control samples, reported recoveries
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited discussion on key uncertainties and limitations

Overall Quality Determination　　　　　**High**

Study Citation:	Kim, S., Kang, S., Lee, G., Lee, S., Jo, A., Kwak, K., Kim, D., Koh, D., Kho, Y. L., Kim, S., Choi, K. (2014). Urinary phthalate metabolites among elementary school children of Korea: Sources, risks, and their association with oxidative stress marker. Science of the Total Environment 472:49-55.		
HERO ID:	2215380		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	enrollment and sampling described
	Metric 2: Analytical Methodology	Medium	LOD in text; equipment described
	Metric 3: Biomarker Selection	High	metabolite in urine
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Korea
	Metric 5: Currency	Medium	2011
	Metric 6: Spatial and Temporal Variability	Medium	first morning void urine; N = 39; no replicates
	Metric 7: Exposure Scenario	High	biomonitoring
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	median and IQR
	Metric 9: Quality Assurance	High	duplicates analyzed, accuracy and precision reported, SI has details
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	variability discussed; uncertainty not discussed, no obvious concerns

Overall Quality Determination   **High**

Study Citation:	Cantonwine, D. E., Cordero, J. F., Rivera-González, L. O., Anzalota Del Toro, L. V., Ferguson, K. K., Mukherjee, B., Calafat, A. M., Crespo, N., Jiménez-Vélez, B., Padilla, I. Y., Alshawabkeh, A. N., Meeker, J. D. (2014). Urinary phthalate metabolite concentrations among pregnant women in Northern Puerto Rico: Distribution, temporal variability, and predictors. Environment International 62:1-11.		
HERO ID:	2215404		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sample collection conducted according to CDC protocols developed for NHANES.
	Metric 2:	Analytical Methodology	Low	Processing procedures conducted according to CDC protocols developed for NHANES; LODs in the "low ng/ml range".
	Metric 3:	Biomarker Selection	High	Metabolite in urine.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Puerto Rico.
	Metric 5:	Currency	Medium	2010-2012.
	Metric 6:	Spatial and Temporal Variability	Medium	n = 139; up to 3 samples per woman; spot urine samples, no replicates.
	Metric 7:	Exposure Scenario	High	Biomonitoring.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	GM, 25th, 50th, 75th, 95th, max provided.
	Metric 9:	Quality Assurance	Medium	To monitor for accuracy and precision, each analytical run included calibration standards, reagent blanks, and quality control materials of high and low concentrations.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Assessed between- and within-person variability (i.e., temporal reliability) in urinary metabolite concentrations.

Overall Quality Determination   Medium

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 additionallyon 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:	Bamai, Y. A., Araki, A., Kawai, T., Tsuboi, T., Saito, I., Yoshioka, E., Kanazawa, A., Tajima, S., Shi, C., Tamakoshi, A., Kishi, R. (2014). Associations of phthalate concentrations in floor dust and multi-surface dust with the interior materials in Japanese dwellings. Science of the Total Environment 468-469:147-157.		
HERO ID:	2215426		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Briefly described, more information found in Kanazawa et al 2010. Missing description on materials used and contamination prevention.
Metric 2:	Analytical Methodology	Medium	Briefly described, more information found in Kanazawa et al 2010. LOD provided and other details, but missing QA/QC description, recoveries
Metric 3:	Biomarker Selection	N/A	NA - Dust samples biomarker not needed.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Sapporo, Japan
Metric 5:	Currency	Medium	2009-2010
Metric 6:	Spatial and Temporal Variability	High	128 samples
Metric 7:	Exposure Scenario	High	Children dwelling patterns and exposure to dust. Unclear if scenario will apply to US children.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Table 3 Stats only
Metric 9:	Quality Assurance	Low	Not well described, briefly mentioned, not reported
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Variability and uncertainty for the studies goal are well described, sampling uncertainty could be better described to fully trust results and conclusions

Overall Quality Determination　　　　Medium

Study Citation:	Berman, T., Goldsmith, R., Göen, T., Spungen, J., Novack, L., Levine, H., Amitai, Y., Shohat, T., Grotto, I. (2013). Urinary concentrations of environmental contaminants and phytoestrogens in adults in Israel. Environment International 59:478-484.		
HERO ID:	2215430		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	recruiting and enrollment described, urine sampling described
	Metric 2:	Analytical Methodology	High	LOD and LOQ in Table 2, LC–MS/MS method - Göen et al., 2011
	Metric 3:	Biomarker Selection	High	metabolite in urine
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Israel
	Metric 5:	Currency	Medium	2011
	Metric 6:	Spatial and Temporal Variability	Medium	urine spot samples, n = 248. no replicates
	Metric 7:	Exposure Scenario	High	urine
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	GM, 50th and 90th provided
	Metric 9:	Quality Assurance	Medium	Quality control of the chemical analyses was performed by the determination of control samples in each series and assessment of the results in control charts for each parameter (internal quality control); German External Quality Assessment Scheme (Göen et al., 2012).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	variability discussed

Overall Quality Determination   High

Domain	Metric		Rating	Comments
Study Citation:		Hu, X., Shi, W., Wei, S., Zhang, X., Feng, J., Hu, G., Chen, S., Giesy, J. P., Yu, H. (2013). Occurrence and potential causes of androgenic activities in source and drinking water in China. Environmental Science & Technology 47(18):10591-10600.		
HERO ID:		2215435		

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling locations identified. Sampling methods on how water was collected not detailed. Preparation of sampling bottles not included and storage conditions after sampling not described.
	Metric 2:	Analytical Methodology	High	GC-MS/MS and LC-MS used for analysis. Mean recoveries and LOQs given in supplemental information.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Yangtze River Basin, Huai River Basin, Tai Lake Basin, andgroundwater in eastern China
	Metric 5:	Currency	Medium	Samples collected in August 2009
	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 the manuscript
	Metric 9:	Quality Assurance	High	Key QA/QC conducted and details reported in supplement.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited gaps and limitations reported

Overall Quality Determination — **High**

Study Citation:			Shin, H. M., Mckone, T. E., Nishioka, M. G., Fallin, M. D., Croen, L. A., Hertz-Picciotto, I., Newschaffer, C. J., Bennett, D. H. (2014). Determining source strength of semivolatile organic compounds using measured concentrations in indoor dust. Indoor Air 24(3):260-271.
HERO ID:			2215665

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling method was discussed in detail, including sampling procedure, storage conditions, and matrix characterization. Information regarding duration of sample storage prior to analysis was lacking.
	Metric 2:	Analytical Methodology	High	The analytical method (GC/MS) was described in terms of instrumentation, extraction, calibration, and recovery, with limits of detection reported within Table S1.
	Metric 3:	Biomarker Selection	N/A	This study sampled for chemicals of interest within indoor dust.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected from residences in Northern California, Southeast Pennsylvania, and Northeast Maryland.
	Metric 5:	Currency	Medium	Samples were collected during 2009 and 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	A total of 30 indoor surface dust samples, one from a single main living room of each house, were collected in an area described as the equivalent of the entire floor surface area of participating homes within Northern California, Southeast Pennsylvania, and Northeast Maryland between 2009 and 2010. Replicate sampling was not detailed.
	Metric 7:	Exposure Scenario	High	The exposure scenario was described and was highly relevant (indoor air) and the study used fugacity-based modeling to predict the emission, fate and movement of chemicals in the indoor environment from various consumer product exposure sources. Use of exposure controls was not detailed.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No individual raw data points were provided. Statistical summary measures included mean, standard deviation, median and maximum concentrations as well as frequency of detection in Table S1.
	Metric 9:	Quality Assurance	Medium	Quality assurance measures were applied and described in robust details. Solvent method blanks were used and recoveries were reported. Baseline, pre-exposure sampling was not conducted.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	The study had a robust discussion of uncertainty and compared results to results of other studies. The study also characterized limitations in details.

Overall Quality Determination   High

Study Citation:	Blanchard, O., Glorennec, P., Mercier, F., Bonvallot, N., Chevrier, C., Ramalho, O., Mandin, C., Le Bot, B. (2014). Semivolatile organic compounds in indoor air and settled dust in 30 French dwellings. Environmental Science & Technology 48(7):3959-3969.		
HERO ID:	2241683		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	**Comment Required**
	Metric 2: Analytical Methodology	High	**Comment Required**
	Metric 3: Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	**Comment Required**
	Metric 5: Currency	Medium	**Comment Required**
	Metric 6: Spatial and Temporal Variability	High	**Comment Required**
	Metric 7: Exposure Scenario	High	**Comment Required**
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	High	**Comment Required**
	Metric 9: Quality Assurance	High	**Comment Required**
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	**Comment Required**

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:	Liu, P., Tian, T., Barreto, J., Chou, J. (2013). Assessment and analysis of phthalate esters, in Lake Pontchartrain, by SPME combining with GC-MS. Environmental Technology 34(1-4):453-462.
HERO ID:	2241701

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	lake water collected from two studied areas (Table 1); timing discussed in "Study areas and waste sample collection"; samples taken in spillway area and the central lake area prior to spillway opening and after the opening of the spillway; central lake area only sampled after; collected in glass bottles and stored in 4C; repeated samples taken from same area over time
	Metric 2:	Analytical Methodology	High	SPME; GC-MS; Table 2 provides LOD per chemical; recoveries
	Metric 3:	Biomarker Selection	N/A	Water sampling
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Lake Pontchartrain, Louisiana
	Metric 5:	Currency	Medium	2008-2009
	Metric 6:	Spatial and Temporal Variability	Medium	Bonnet Carre Spillway had 6 sampling sites, taken in April and continued after opening (May, June, and October 2008 and April and June 2009) - totalling 42 samples; Central lake area had 6 location sites, taken in April then again June and October 2008 and continued January, March, May and June of 2009 - totaling 54 samples. no replicate sampling or analysis
	Metric 7:	Exposure Scenario	High	concentration in largest lake in Louisiana and examined effect of spillway opening on contamination
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Figures 6 and 7 provide concentrations of sum of total phthalates; text starting p.459 provides range and DF per site as well as a few other stats.
	Metric 9:	Quality Assurance	High	Recovery rate provided in Table 3
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	average and relative standard deviation provided in Table 3; compares total phthalate concentrations before and after spillway opening

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:	Mercier, F., Gilles, E., Saramito, G., Glorennec, P., Le Bot, B. (2014). A multi-residue method for the simultaneous analysis in indoor dust of several classes of semi-volatile organic compounds by pressurized liquid extraction and gas chromatography/tandem mass spectrometry. Journal of Chromatography A 1336:101-111.
HERO ID:	2298081

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Dust collected from household vacuum bags, sieved before sealed/frozen storage.
	Metric 2:	Analytical Methodology	High	Analysis via PLE-GC/MS/MS explained in detail with LOQ, matrix interference, etc.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	France, Brittany.
	Metric 5:	Currency	Medium	September 2009 through October 2012.
	Metric 6:	Spatial and Temporal Variability	Medium	N = 7 vacuum bags, 1 per dwelling.
	Metric 7:	Exposure Scenario	High	Indoor dust from family dwellings.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data reported (n = 7).
	Metric 9:	Quality Assurance	High	Extensive QA to evaluate analytic methods; used SRM from US NIST; 3-level quantitative calibration.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Indoor dust, 1 analytic measure/dwelling, n = 7 dwellings; focus on performance of GC/MS/MS methods.

Overall Quality Determination   High

Study Citation:	Christensen, K., Sobus, J., Phillips, M., Blessinger, T., Lorber, M., Tan, Y. M. (2014). Changes in epidemiologic associations with different exposure metrics: A case study of phthalate exposure associations with body mass index and waist circumference. Environment International 73:66-76.		
HERO ID:	2345925		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Sampling procedure was reported throughout the first half of the paper; Simulation section has the most details.
Metric 2:	Analytical Methodology	Low	Analytical method was not reported. However, data came from NHANES dataset which uses scientifically sound and robust methods.
Metric 3:	Biomarker Selection	Low	MiBP can also be a metabolite for DBP.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Data were collected from the US population.
Metric 5:	Currency	Medium	Data were collected from 2009-2010.
Metric 6:	Spatial and Temporal Variability	Medium	Sample data include 10537 individuals. To be consistent with the guidance, metric is not scored as high because of missing replicates.
Metric 7:	Exposure Scenario	Medium	The data represent relevant exposure scenario, but did not have much information on exposure pathway/product use.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Average data were reported. While sample size exceeded 10,000 so presenting raw data is less feasible, to be consistent with the guidance, the metric is not scored high.
Metric 9:	Quality Assurance	Low	QA/QC techniques were not discussed, but can be inferred from use of NHANES data.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	The study had some characterization of variance and discussion on its strength and limitation regarding the simulation.

Overall Quality Determination   Medium

Study Citation:	Ait Bamai, Y., Shibata, E., Saito, I., Araki, A., Kanazawa, A., Morimoto, K., Nakayama, K., Tanaka, M., Takigawa, T., Yoshimura, T., Chikara, H., Saijo, Y., Kishi, R. (2014). Exposure to house dust phthalates in relation to asthma and allergies in both children and adults. Science of the Total Environment 485-486(Elsevier):153-163.		
HERO ID:	2345943		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Methods, equipment, storage described. Additional methods were published in previous manuscripts (Araki et al., 2014; Kanazawa et al., 2010; Saito et al., 2007)
Metric 2:	Analytical Methodology	High	Extraction methods, analytical instrument (GC/MS), MDL, and recoveries reported. A calibration curve was constructed for GC/MS analysis.
Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Japan
Metric 5:	Currency	Medium	sampling in 2006
Metric 6:	Spatial and Temporal Variability	High	More than 100 samples per matrix with replicates.
Metric 7:	Exposure Scenario	High	Exposure to children and adults.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Only summary statistics. No individual data.
Metric 9:	Quality Assurance	High	Control samples were analyzed, QA/QC method was described. High recoveries (over 70%).
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Variability measured in the characteristics of subjects. Uncertainties and limitations were discussed.

Overall Quality Determination   High

Study Citation:	Ferguson, K. K., Mcelrath, T. F., Ko, Y. A., Mukherjee, B., Meeker, J. D. (2014). Variability in urinary phthalate metabolite levels across pregnancy and sensitive windows of exposure for the risk of preterm birth. Environment International 70(Elsevier):118-124.		
HERO ID:	2345949		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Low	Sampling methods were reported as CDC guidelines, detailed elsewhere.
Metric 2:	Analytical Methodology	Low	Analytical methods were assumed to be appropriate (following CDC guidelines) but not detailed
Metric 3:	Biomarker Selection	High	Biomarker (parent chemical or metabolite) is derived from exposure to the chemical of interest.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Boston
Metric 5:	Currency	Medium	2006 to 2008
Metric 6:	Spatial and Temporal Variability	Medium	The study included 130 mothers who delivered preterm, aswell as 352 controls selected randomly from subjects who had a urine sample from Visit 1 and from at least one additional visit. No indication of replicates
Metric 7:	Exposure Scenario	Medium	The data likely represent the relevant exposure scenario.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Individual data points were not reported, but supplementary tables provided information with detailed summary statistics.
Metric 9:	Quality Assurance	Low	Quality assurance/quality control techniques and results were not directly discussed, but can be implied through the study's use of standard field and laboratory protocols.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	The study has limited discussion of key uncertainties, limitations, and data gaps, though the study mainly provided its strengths.

Overall Quality Determination   Medium

Study Citation:			Serrano, S. E., Karr, C. J., Seixas, N. S., Nguyen, R. H., Barrett, E. S., Janssen, S., Redmon, B., Swan, S. H., Sathyanarayana, S. (2014). Dietary phthalate exposure in pregnant women and the impact of consumer practices. International Journal of Environmental Research and Public Health 11(6):6193-6215.
HERO ID:			2345950

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Sampling procedure was provided and included details on equipment, storage, and calibration. A copy of the survey questions is in the supplemental information.
	Metric 2: Analytical Methodology	High	Analytical procedure was reported (HPLC-ESI-MS/MS). LOD was reported (0.2 and 2.0 ng/mL for the UW samplesand 0.2 and 0.6 ng/mL for the CDC samples). Data below LOD was properly addressed.
	Metric 3: Biomarker Selection	High	Biomarker (parent chemical or metabolite) is derived from exposure to the chemical of interest.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Participants are from hospitals in several states in the US
	Metric 5: Currency	Medium	2010-2012
	Metric 6: Spatial and Temporal Variability	High	656 final samples were included
	Metric 7: Exposure Scenario	High	The data closely represent relevant exposure scenario - concentrations in serum and dietary exposure/consumer practices was explored in details.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Average concentrations of metabolites were reported, no raw data were reported. Demographics, education, food consumption, personal care products and other consumer related practices summaries available in Table 2, 3, and 4.
	Metric 9: Quality Assurance	High	QC was performed, no major concerns were seen.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	High	The study had a robust discussion of limitations and variability.

Overall Quality Determination   High

Study Citation:	Gaspar, F. W., Castorina, R., Maddalena, R. L., Nishioka, M. G., Mckone, T. E., Bradman, A. (2014). Phthalate exposure and risk assessment in California child care facilities. Environmental Science & Technology 48(13):7593-7601.		
HERO ID:	2345959		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Sampling methodology was thoroughly described including the study population, visits, dust and indoor air sample collection procedures and sample storage.
	Metric 2: Analytical Methodology	High	Analytical methodologies for dust and indoor air samples were described in detail including extraction method, analytical instrumentation, reproducible samples. The method detection limit (MDL) for dust and instrument limit of detection (IDL) for indoor air were reported in text on page 7594. Recovery percentages are reported in the SI table S1.
	Metric 3: Biomarker Selection	N/A	This study measured the parent chemical in environmental media.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	The study was completed at the Alameda and Monterey Counties, California.
	Metric 5: Currency	Medium	Samples were collected from May 2010 to May 2011.
	Metric 6: Spatial and Temporal Variability	Medium	40 early childhood education facilities were enrolled in the study. Indoor air samples were collected from all 40 locations and dust samples were collected from 39 locations. Replicate samples were not reported.
	Metric 7: Exposure Scenario	High	This data in this study suggests chemical exposure to children through dust and indoor air in early childhood education facilities. There were no exposure control samples.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Summary statistics of dust and indoor air concentrations were detailed including mean, standard deviation, range, detection frequency, and percentiles. Raw data were not reported.
	Metric 9: Quality Assurance	High	QA/QC procedures were reporting including relative percent difference, field duplicates, field blanks, field spikes, and laboratory spikes are presented in SI Table S1.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	High	Variability of dust and indoor air were well characterized. The study reported the standard deviation, range, 5th, 25th, 50th, 75th, and 95th percentiles of concentrations. Limitations were reported in the discussion section.

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

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Spot urine samples collected either at home or in clinic (some in both); diaper inserts used for ages 1 to 3 years.
Metric 2:	Analytical Methodology	Low	Described in SI. SPE-HPLC-MS/MS. Analyses performed by CDC laboratory following strict CLIA QC guidelines. Followed 2011-2012 NHANES protocols for phthalate metabolites. LOD reported only as range (0.1 to 1 ng/mL), however.
Metric 3:	Biomarker Selection	Medium	Concentration of MiBP in urine. Results limited to ages 4 and 5 years due to contamination by diaper inserts.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Ohio, Cincinnati
Metric 5:	Currency	Medium	2004 through 2011
Metric 6:	Spatial and Temporal Variability	Low	Spot urine samples: compared at home versus clinic collection; compared samples taken 2 weeks apart to those taken 1 year apart for same individual. Total 296 children ages 1 through 5 years.
Metric 7:	Exposure Scenario	Medium	Questionnaires covered diet, food packaging, consumption of fast food, and personal product use.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Reported in Supplemental Information. Concentrations (ug/L) reported: median, 25th, and 75th percentiles (Table S3); box-and-whisker plots also show arithmetic mean, min, and max (Figure S1).
Metric 9:	Quality Assurance	High	CDC followed quality control as per the Clinical Laboratory Improvement Act QC guidelines and German External Quality Assessment Scheme.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Evaluated metabolite concentrations relative to demographic characteristics, food packaging and personal care products, age, and other factors.

Overall Quality Determination   Medium

Study Citation:	Frederiksen, H., Kuiri-Hänninen, T., Main, K. M., Dunkel, L., Sankilampi, U. (2014). A longitudinal study of urinary phthalate excretion in 58 full-term and 67 preterm infants from birth through 14 months. Environmental Health Perspectives 122(9):998-1005.		
HERO ID:	2347101		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Most key criteria met - including equipment and storage. Duration of sample storage prior to analysis lacking.
Metric 2:	Analytical Methodology	Medium	Most key criteria met - instrument described, recoveries, analytic methods referenced (Frederiksen et al. 2010) with more information, LOD's reported, creatine adjusted concentrations.
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 Kuopio, Finland.
Metric 5:	Currency	Medium	Sampling conducted 2006-2008.
Metric 6:	Spatial and Temporal Variability	Medium	Spot urine sampling conducted with repeated samples provided by n=125 children at days 1-3, day 7, monthly at months 1-6 and month 14, with a total of 894 urine specimens provided, non-statistical sampling approach.
Metric 7:	Exposure Scenario	Medium	Participant characteristics described, occupational status of mother not reported, lack of exposure controls however repeated sampling provided over 14 months.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Most key criteria met. Lack of raw data. Summary statistics and mean reported.
Metric 9:	Quality Assurance	High	Key criteria met, lack of baseline pre-exposure data however repeated sampling over 14 months. Recoveries reported.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Variability characterized within summary statistics and different variables, potential limitations discussed, including the potential for reverse causality within premature infants.

Overall Quality Determination   High

Study Citation:		Valton, A. S., Serre-Dargnat, C., Blanchard, M., Alliot, F., Chevreuil, M., Teil, M. J. (2014). Determination of phthalates and their by-products in tissues of roach (Rutilus rutilus) from the Orge river (France). Environmental Science and Pollution Research 21(22):12723-12730.		
HERO ID:		2347469		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sample collection described for fish (roach) upstream and downstream. Location and map provided plus site description and some history. River surface water collected via grab sample method. Fish livers and muscles were collected after dissection in the lab. Missing approaches to avoid phthalate contamination, missing surface grab water description such as approximate thickness of surface layer sampled.
	Metric 2:	Analytical Methodology	High	Sample processing, methods, and equipment provided. Phthalates diesters were analyzed by high resolution gas chromatography/mass spectrometry. Phthalate monoesters were quantified as triplicates, by high performance liquid chromatography (1200 series; Agilent Technologies, Massy, France)–tandem mass spectrometry, (HPLC-MS/MS). Limits of quantification (LOQs) for roach tissues are indicated in Appendix 2 and 4.
	Metric 3:	Biomarker Selection	High	Biomarkers selected are appropriate for parent phthalates, see table 3 for DEHP metabolites. Table 2 has metabolites for other phthalates.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	France
	Metric 5:	Currency	Low	publication date 2014, sampling date not provided
	Metric 6:	Spatial and Temporal Variability	Low	n = 4 for liver and muscle, unclear about surface water
	Metric 7:	Exposure Scenario	Medium	fish from the Orge River and surface water
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	mean and SD reported in Table 1
	Metric 9:	Quality Assurance	High	Analytical QA/QC described and reported in appendices. Blanks, internal standards, recoveries, LOQs and triplicate analysis of each sample.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Sources of uncertainty and variability discussed in Roach contamination Section of the paper starting page 8.

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**

Domain		Metric	Rating	Comments
Study Citation:		Van Holderbeke, M., Geerts, L., Vanermen, G., Servaes, K., Sioen, I., De Henauw, 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 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methods not reported such as sample storage conditions
	Metric 2:	Analytical Methodology	High	analytical methods described
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
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:	Frederiksen, H., Kranich, S. K., Jørgensen, N., Taboureau, O., Petersen, J. H., Andersson, A. M. (2013). Temporal variability in urinary phthalate metabolite excretion based on spot, morning, and 24-h urine samples: considerations for epidemiological studies. Environmental Science & Technology 47(2):958-967.		
HERO ID:	2516456		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Detailed sampling methods, including timing of collection, storage, and equipment used.
	Metric 2: Analytical Methodology	High	Well described analytical methods, including instrument, calibration curve, LOD, blank urine pool provided.
	Metric 3: Biomarker Selection	High	Metabolites known to be derived from parent chemical (MiBP).
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Denmark
	Metric 5: Currency	Medium	Samples taken in 2008
	Metric 6: Spatial and Temporal Variability	High	n=33, with triplicates over a three month period. 24 hr, morning void, and spot samples all collected.
	Metric 7: Exposure Scenario	Medium	Men sampled but there is little information given about them and source of exposure.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Only summary statistics (min, max, percentiles). No individual points.
	Metric 9: Quality Assurance	High	Described QA/QC techniques described in another study, analyzed control samples. High recoveries (over 70%).
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	High	Characterized variability, discussed uncertainties and limitations, and compared the different modes of urine collection.

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

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

Overall Quality Determination   Medium

Study Citation:	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. Environmental Pollution 195:16-23.		
HERO ID:	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:	Watkins, D. J., Téllez-Rojo, M. M., Ferguson, K. K., Lee, J. M., Solano-Gonzalez, M., Blank-Goldenberg, C., Peterson, K. E., Meeker, J. D. (2014). In utero and peripubertal exposure to phthalates and BPA in relation to female sexual maturation. Environmental Research 134:233-241.		
HERO ID:	2519083		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The study population and sample collection methods were described.
	Metric 2:	Analytical Methodology	Medium	LOD provided in Table 1. Samples were analyzed at NSF International using ID-LC-MS/MS and specific gravity was accounted for. Other details were not reported.
	Metric 3:	Biomarker Selection	High	MiBP is specific to DiBP.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was performed in Mexico.
	Metric 5:	Currency	Medium	Study was performed in 2010.
	Metric 6:	Spatial and Temporal Variability	Low	Over 100 samples were collected from both mothers and children without replicates. Furthermore, only un-pooled urine spot samples were collected.
	Metric 7:	Exposure Scenario	High	This is a biomonitoring study were exposure already occurred in utero for children.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Geometric means and percentiles were provided, but not raw data.
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variance was not characterized and uncertainties, limitations, and data gaps were not discussed.

Overall Quality Determination   Medium

Diisobutyl Phthalate   Monitoring   HERO ID: 2519084

Study Citation:	Cutanda, F., Koch, H. M., Esteban, M., Sánchez, J., Angerer, J., Castaño, A. (2015). Urinary levels of eight phthalate metabolites and bisphenol A in mother-child pairs from two Spanish locations. International Journal of Hygiene and Environmental Health 218(1):47-57.		
HERO ID:	2519084		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Standard Operation Procedures (SOPs) were followed in the collection of samples (Schindler et al., 2014). Missing approaches to avoid contamination, although it could be described in Schindler et al.
	Metric 2:	Analytical Methodology	Medium	Assessment done by Institute for Prevention and Occupational Medicine (IPA) laboratory (Koch et al., 2012, 2013; Kasper-Sonnenberg et al., 2012a,b). LOQ provided. Use on-line LC/LC–MS/MS with isotope dilution after enzymatic deconjugation.
	Metric 3:	Biomarker Selection	High	Metabolite in urine, see Table 1
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Spain
	Metric 5:	Currency	Medium	2011-2012
	Metric 6:	Spatial and Temporal Variability	High	n = 118 mothers and 119 children, no replicates, urine morning void
	Metric 7:	Exposure Scenario	High	Biomonitoring, mother and child
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not provided, summary tables in supplemental: GM, P95, max.
	Metric 9:	Quality Assurance	Medium	external quality assurance by the Quality Assessment Unit of COPHES/DEMOCOPHES as described in detail by Schindler et al. (2014).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variability between rural and urban locations was described as well as food consumption as a source of the variability among groups.

Overall Quality Determination   **High**

Study Citation:	Fu, P., Kawamura, K., Barrie, L. A. (2009). Photochemical and other sources of organic compounds in the Canadian high Arctic aerosol pollution during winter-spring. Environmental Science & Technology 43(2):286-292.		
HERO ID:	2592659		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Sampling methodology reported.
	Metric 2: Analytical Methodology	High	Analytical methodology well described.
	Metric 3: Biomarker Selection	N/A	Chemical in environmental media (air).
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Geographic location is reported; Canadian high Arctic.
	Metric 5: Currency	Low	Data collected Feb to June 1991. Timing of sample collection for monitoring data is not consistent with when current exposures (>15 years old) may be expected and likely to have a substantial impact on results.
	Metric 6: Spatial and Temporal Variability	Low	Sample size not reported but samples collected weekly from February to June.
	Metric 7: Exposure Scenario	High	Chemicals in the Canadian high Arctic aerosol.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	High	Supplementary or raw data (i.e., individual data points) are reported in the supplemental file, allowing summary statistics to be calculated or reproduced.
	Metric 9: Quality Assurance	High	The study applied QA/QC measures such as field and lab control samples. Recoveries were high. No QA/QC issues identified.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Low	No limitations and uncertainties discussed. However, no standard deviation or other measure of variance is provided.

Overall Quality Determination   Medium

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

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

Overall Quality Determination   Medium

Study Citation:	Den Hond, E., Govarts, E., Willems, H., Smolders, R., Casteleyn, L., Kolossa-Gehring, M., Schwedler, G., Seiwert, M., Fiddicke, U., Castaño, A., Esteban, M., Angerer, J., Koch, H. M., Schindler, B. K., Sepai, O., Exley, K., Bloemen, L., Horvat, M., Knudsen, L. E., Joas, A., Joas, R., Biot, P., Aerts, D., Koppen, G., Katsonouri, A., Hadjipanayis, A., Krskova, A., Maly, M., Mørck, T. A., Rudnai, P., Kozepesy, S., Mulcahy, M., Mannion, R., Gutleb, A. C., Fischer, M. E., Ligocka, D., Jakubowski, M., Reis, M. F., Namorado, S., Gurzau, A. E., Lupsa, I. R., Halzlova, K., Jajcaj, M., Mazej, D., Snoj Tratnik, J., López, A., Lopez, E., Berglund, M., Larsson, K., Lehmann, A., Crettaz, P., Schoeters, G. (2014). First steps toward harmonized human biomonitoring in Europe: Demonstration project to perform human biomonitoring on a European scale. Environmental Health Perspectives 123(3):255-263.		
HERO ID:	2718042		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	The sampling methodology is based on the European consensus protocol of COPHES.
	Metric 2: Analytical Methodology	High	Samples were analyzed following a interlaboratory SOP, more information found in (Becker et al. 2014, Schindler et al. 2014). LOQ are reported per country and metabolite.
	Metric 3: Biomarker Selection	High	Metabolite known to be derived from parent chemical (MiBP).
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Samples were collected in 17 European countries in urban and rural areas following a protocol.
	Metric 5: Currency	Medium	2010-2012
	Metric 6: Spatial and Temporal Variability	Medium	1844 paired children and mother. No replicate samples. Morning urine samples.
	Metric 7: Exposure Scenario	High	Mother and children living in 17 European countries in urban and rural areas
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	No individual results reported, but GM and (95%CI) reported.
	Metric 9: Quality Assurance	High	The study had two interlaboratory comparison investigations and two external quality assessment schemes (ICI/EQUAS).
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	The study characterizes variability in the demographics and behaviors of the study population, but does not report limitations.

Overall Quality Determination   High

| Study Citation: | Kong, L., Kadokami, K., Wang, S., Duong, H. T., Chau, H. T. (2015). Monitoring of 1300 organic micro-pollutants in surface waters from Tianjin, North China. Chemosphere 122:125-130. |
| HERO ID: | 2718045 |

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	The sampling method summary was brief but comprehensive.
Metric 2:	Analytical Methodology	High	Extraction methods and use of various mass spectrometry was described.
Metric 3:	Biomarker Selection	N/A	Parent chemical in an environmental media.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Sampling occurred in three watersheds in China.
Metric 5:	Currency	Medium	Data was collected in 2013.
Metric 6:	Spatial and Temporal Variability	Medium	No replicates were collected.
Metric 7:	Exposure Scenario	High	Potential sources of exposure in surface water were identified.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	High	Raw data was provided in supplemental Excel file.
Metric 9:	Quality Assurance	High	QA/QC was reported and included blanks, spiked samples, and cleaning procedures.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	No gaps nor limitations were reported.

Overall Quality Determination   High

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

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

Overall Quality Determination   Medium

Study Citation: 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 Ottowa 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	Low	Sampling for metabolites (MiBP) not specific for parent chemical (DiBP) 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	Data only reported the relationships between MBzP and plaques rather than blood levels of MBzP. There is a limited discussion of potential study limitations and low frequency of detection.

Overall Quality Determination   Low

| | 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:	Huang, Y., Lu, W. W., Chen, B., You, J., Wu, M., Li, S. G. (2014). Phthalates in commercial chinese rice wines: concentrations and the cumulative risk assessment to adult males in shanghai. Biomedical and Environmental Sciences 27(10):819-823.		
HERO ID:	2804038		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Low	Several sampling methods not reported such as sample storage conditions and sampler calibration
Metric 2:	Analytical Methodology	Medium	Some analytical methods not reported such as instrument calibration
Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Shanghai, China
Metric 5:	Currency	Medium	Study conducted in 2014
Metric 6:	Spatial and Temporal Variability	Medium	>10 samples; no replicates
Metric 7:	Exposure Scenario	Medium	Consumption of rice wine, may be applicable to certain demographic groups within general population.
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	Low	Few gaps and limitations reported

Overall Quality Determination   Medium

Study Citation: Vandermarken, T., De Galan, S., Croes, K., Van Langenhove, K., Vercammen, J., Sanctorum, H., Denison, M. S., Goeyens, L., Elskens, M., Baeyens, W. (2016). Characterisation and implementation of the ERE-CALUX bioassay on indoor dust samples of kindergartens to assess estrogenic potencies. Journal of Steroid Biochemistry and Molecular Biology 155(Pt B):182-189.

HERO ID: 2807610

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Dust samples were collected in 12 kindergarten classrooms in Belgium. Used a vacuum cleaner with a phthalate free glass fiber thimble in addition to other teflon and stainless steel parts to avoid contamination. Vacuum was set to collect 2cm above the ground to avoid scraping floors. Collected approx. 250 mg of dust after 2 min of 1m square surface. Classroom interior was documented and reported.
Metric 2:	Analytical Methodology	High	This study was about comparing sample collection to a bioassay technique. We are interested in the collected dust samples. The collected dust samples were extracted using EPA method 3620c and analyzed via gas chromatography mass spectrometry. Internal standards, blanks, and LODs reported. Details of analysis and extraction reported in their own sections.
Metric 3:	Biomarker Selection	N/A	NA - Dust samples no biomarker needed.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Flanders and Brussels, Belgium
Metric 5:	Currency	Low	Sampling date not specified, publication date 2016.
Metric 6:	Spatial and Temporal Variability	Medium	One sample in 12 locations, no replicate.
Metric 7:	Exposure Scenario	High	Children indoor environment and dust concentrations.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Table 4 concentrations in dust. Blank corrected, so no raw data provided.
Metric 9:	Quality Assurance	High	Analytical QA/QC was reported and is reliable.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Sources of variability and uncertainty between the two approaches were discussed, also discussed the various classroom content and potential sources of variability and uncertainty.

Overall Quality Determination   High

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: | Wang, X., Tao, W., Xu, Y., Feng, J., Wang, F. (2014). Indoor phthalate concentration and exposure in residential and office buildings in Xi'an, China. Atmospheric Environment 87(Elsevier):146-152. |
| HERO ID: | 2816655 |

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods for gas phase, particulate and dust provided. Particulate sampler was up to 10 microm. Samplers described, blanks used, dust samples collected in glass fiber membrane
	Metric 2:	Analytical Methodology	Medium	LOD not reported in text or supplemental. All other analytical method were described in text and supplemental. If LOD was provided this would be high.
	Metric 3:	Biomarker Selection	N/A	NA - Gas, particulate and dust samples no biomarker needed.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	Medium	Data collected in 2012 and 2013
	Metric 6:	Spatial and Temporal Variability	Medium	no replicates collected
	Metric 7:	Exposure Scenario	Medium	Indoor air, particulate and dust concentrations provided. The summary table 1 mixes offices (working) with residential which might not be applicable to our separate worker and general population scenarios.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	no raw data reported
	Metric 9:	Quality Assurance	High	Described in supplemental analytical methods
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	No gaps nor limitations reported

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: Robledo, C. A., Peck, J. D., Stoner, J., Calafat, A. M., Carabin, H., Cowan, L., Goodman, J. R. (2015). Urinary phthalate metabolite concentrations and blood glucose levels during pregnancy. International Journal of Hygiene and Environmental Health 218(3):324-330.

HERO ID: 2816868

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 and equipment reported. Recovery samples and calibration not reported.
	Metric 3:	Biomarker Selection	Low	MiBP is a measured metabolite but the study does not mention DIBP as a parent chemical.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Oklahoma
	Metric 5:	Currency	Medium	Samples collected in 2008
	Metric 6:	Spatial and Temporal Variability	Low	110 samples. No replicates. Spot urine samples.
	Metric 7:	Exposure Scenario	High	Measuring exposure in pregnant women.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Only geometric mean and percentiles reported. Raw data not provided.
	Metric 9:	Quality Assurance	Low	QA not reported but can be implied.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Gaps and limitations reported. No measure of variability.

Overall Quality Determination   Medium

Study Citation:	Tran, T. M., Kannan, K. (2015). Occurrence of phthalate diesters in particulate and vapor phases in indoor air and implications for human exposure in Albany, New York, USA. Archives of Environmental Contamination and Toxicology 68(3):489-499.		
HERO ID:	2816872		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling method, matrix, equipment, and storage were described.
	Metric 2:	Analytical Methodology	Medium	GC/MS was used to analyze the samples. MDL and MQL were determined and reported in the SI, but SI is not available. Text provides a range for all chemicals analyzed.
	Metric 3:	Biomarker Selection	N/A	Study tested for parent chemicals in indoor air.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was performed in Albany, NY.
	Metric 5:	Currency	Medium	Samples were collected in 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	Samples were collected in 6 categories and each category has 6 to 20 data points. No replicates were collected.
	Metric 7:	Exposure Scenario	High	The data represents a relevant exposure scenario (indoor air in homes, offices, schools, labs, schools, salons, and some public places).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Mean concentrations were reported with summary statistics. No individual data were reported.
	Metric 9:	Quality Assurance	High	QA/QC were performed and no major concerns were seen. Recoveries were above 90% for PUFs and above 82% for the glass fiber filter.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	There is a limited discussion of uncertainties, limitations, and data gaps.

Overall Quality Determination   Medium

Study Citation:	Bekö, G., Callesen, M., Weschler, C. J., Toftum, J., Langer, S., Sigsgaard, T., Høst, A., Kold Jensen, T., Clausen, G. (2015). Phthalate exposure through different pathways and allergic sensitization in preschool children with asthma, allergic rhinoconjunctivitis and atopic dermatitis. Environmental Research 137:432-439.		
HERO ID:	2823294		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	The sampling methodology was outlined and seemed high-quality, but specific details were lacking in this paper (though covered in depth in other papers).
Metric 2:	Analytical Methodology	Low	Analytical methods were described in a previous publication and are not summarized. They mention assuming non-detects were half the limits of detection but do not identify individual LODs.
Metric 3:	Biomarker Selection	High	Metabolites of phthalates were measured in urine (and the parent phthalates were analyzed in dust).
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Denmark
Metric 5:	Currency	Medium	The study began in 2008 and was submitted for publication in 2014.
Metric 6:	Spatial and Temporal Variability	Medium	There were 200 study participants with allergic conditions and 166 controls. Duplicates of both dust and urine samples were analyzed. Urine samples were first-morning voids, so assigned this metric as medium.
Metric 7:	Exposure Scenario	High	Data closely represent a relevant exposure scenario.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Low	Only summary statistics are provided - medians and means. Even in the supplementary files, there are no raw data, ranges, standard deviations, etc. The narrative and a footnote to the table say there were 166 controls, but the table then lists n=164 controls, a possible minor error. Consult the other papers associated with this study for more detailed data, particularly:(1) Callesen, M., Bekö, G., Weschler, C.J., Sigsgaard, T., Jensen, T.K., Clausen, G., et al., 2014a. Associations between selected allergens, phthalates, nicotine, PAHs and bedroom ventilation and clinically confirmed asthma, rhinoconjunctivitis and atopic dermatitis in preschool children. Indoor Air 24 (2), 136–147. (2) Callesen, M., Bekö, G., Weschler, C.J., Langer, S., Brive, L., Clausen, G., et al., 2014b. Phthalate metabolites in urine and asthma, allergic rhinoconjunctivitis and atopic dermatitis in preschool children. Int. J. Hyg. Environ. Health 217, 645–652.
Metric 9:	Quality Assurance	Low	Blanks were analyzed, but there are no details regarding QA/QC in this paper. It was discussed in one of the prior papers that further elaborated on methods.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	There was a brief discussion of a few uncertainties/limitations. The only discussion of variability was the comment that the data suggest that associations between phthalate exposures and allergic sensitization among children with allergic symptoms may be more pronounced in the non-healthy children.

Overall Quality Determination   Medium

Study Citation:	Gong, M., Weschler, C. J., Liu, L., Shen, H., Huang, L., Sundell, J., Zhang, Y. (2015). Phthalate metabolites in urine samples from Beijing children and correlations with phthalate levels in their handwipes. Indoor Air 25(6):572-581.		
HERO ID:	2823304		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Parents were asked to collect their children's first morning urine in a 60 ml pre-cleaned brown glass jar on the day after handwipe sampling and then store the sample in a freezer before the investigators' visit. After transporting the urine samples to the laboratory on ice, they were stored at 36°C until analysis.
Metric 2:	Analytical Methodology	Medium	Analytical methods used a method modified from Silva et al. (2007) and described in our previous study (Liu et al., 2012).
Metric 3:	Biomarker Selection	Medium	Metabolite known to be derived from parent chemical (MiBP).
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	China
Metric 5:	Currency	Medium	Samples collected in 2013 and 2014
Metric 6:	Spatial and Temporal Variability	Medium	67 samples. No replicates. Morning urine samples.
Metric 7:	Exposure Scenario	High	Looking at association between phthalate exposure in children handwipes and children urine.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Raw data not reported. Summary statistics (mean, min, max) reported.
Metric 9:	Quality Assurance	Medium	QA not directly discussed, but Fudan University's Ethical Review Board approved the study protocol prior to collection of allhandwipe and urine samples (IRB00002408 and 573 Phthalates in handwipes; metabolites in urine FWA00002399).
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Variability in seasons measured and results compared to other studies. No gaps and limitations reported.

Overall Quality Determination   **Medium**

Study Citation: Khalil, M. M. H., Gomaa, A. M., Sebaei, A. S., Moustapha, N. M. (2014). Distribution of phthalate esters in Egyptian edible oil. Journal of Essential Oil Bearing Plants 17(6):1343-1351.

HERO ID: 2823325

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methods only reported the total number of samples and collection date. There is no information about equipment, procedure, regimen, storage, etc.
	Metric 2:	Analytical Methodology	High	Key analytical methods reported, including extraction method, instrumentation, GC-MS, calibration, and LOD/LOQ in Table 1.
	Metric 3:	Biomarker Selection	N/A	Study tested for parent compounds in food.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was conducted in Egypt.
	Metric 5:	Currency	Medium	Samples were collected in 2013 and 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	A total of 27 samples were collected with no replicates.
	Metric 7:	Exposure Scenario	High	Exposure to phthalates migrated from food packing materials to the food inside is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data were not reported. Summary statistics are missing. There is no concentration data, only detection frequency in Figure 4.
	Metric 9:	Quality Assurance	Low	There is limited QA/QC reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Uncertainties are reported, but no characterization of variance.

Overall Quality Determination   Medium

Study Citation:	Agay-Shay, K., Martinez, D., Valvi, D., Garcia-Esteban, R., Basagaña, X., Robinson, O., Casas, M., Sunyer, J., Vrijheid, M. (2015). Exposure to Endocrine-Disrupting Chemicals during Pregnancy and Weight at 7 Years of Age: A Multi-pollutant Approach. Environmental Health Perspectives 123(10):1030-1037.		
HERO ID:	2854577		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Enrollment described. Study protocol was not described but cited as provided elsewhere (Guxens et al. 2012).
	Metric 2: Analytical Methodology	Low	Table 1 attempted to describe LOD, but overall was not informative.
	Metric 3: Biomarker Selection	High	MiBP is not a metabolite specific to DiBP (can also be a metabolite for DBP).
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Study was performed in Spain.
	Metric 5: Currency	Low	Samples were collected between 2004 and 2006.
	Metric 6: Spatial and Temporal Variability	Medium	There were 470 samples but no replicates.
	Metric 7: Exposure Scenario	High	This is a biomonitoring where (prental) exposure has occurred.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Table 1 shows GM, mean, max, and min. Raw data were not provided.
	Metric 9: Quality Assurance	Low	QA/QC was not discussed.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Low	There was a limited characterization of variance (through range) and no discussion of uncertainties, gaps, or limitations.

Overall Quality Determination   **Medium**

Study Citation:	Li, B., Hu, X., Liu, R., Zeng, P., Song, Y. (2015). Occurrence and distribution of phthalic acid esters and phenols in Hun River Watersheds. Environmental Earth Sciences 73(9):5095-5106.		
HERO ID:	2855033		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Authors provided a detail site description and sampling sites along the two rivers in Figure 1. Surface water was collected in 2L glass bottles during the spring, summer, and autumn. Samples were filtered, stored at 4C, and processed within one day.
	Metric 2: Analytical Methodology	High	Extraction, instrumentation, analytical methods, and recoveries were described. A range for LODs/LOQs were provided in the main text, and individual values are available in Table S1.
	Metric 3: Biomarker Selection	N/A	Study tested parent chemicals in surface water.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Samples were collected at the Xi River (XR) and Pu River (PR), tributaries of Hun River Watersheds (HRW) in Liao River Basin (LRB), northeast China.
	Metric 5: Currency	Medium	Samples were collected in 2013.
	Metric 6: Spatial and Temporal Variability	Medium	It is unclear what the total number of samples were. However, eight sites in Xi River and 11 in Pu River were selected for sampling in May, August, and October of 2013. If one sample was collected per site per month, that will well exceed 10 samples. No replicates were collected.
	Metric 7: Exposure Scenario	High	Surface water levels from two rivers historically polluted by printing and dyeing enterprises and pharmaceutical and chemical industries. This pollution can expose aquatic life and local residents to harmful chemicals.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Table 1 provides the range, mean, and std by season and river. Raw data were not provided.
	Metric 9: Quality Assurance	High	All data subject to strict QC procedures (e.g., blank contamination control) that were well described. Average recoveries ranged from 91-126% (RSD 7-12%).
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Standard deviations provided, but little discussion of limitations, uncertainties, and data gaps.

Overall Quality Determination   High

		Domain	Metric	Rating	Comments

Study Citation: Myridakis, A., Fthenou, E., Balaska, E., Vakinti, M., Kogevinas, M., Stephanou, E. G. (2015). Phthalate esters, parabens and bisphenol-A exposure among mothers and their children in Greece (Rhea cohort). Environment International 83:1-10.

HERO ID: 2914665

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Well-described sampling methodology, scientifically sound.
	Metric 2:	Analytical Methodology	High	Detailed analytical methods, reported LOD, described recoveries.
	Metric 3:	Biomarker Selection	High	Biomarker is known to be related to external exposure to phthalates.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Greece
	Metric 5:	Currency	Low	Sampling began in 2007.
	Metric 6:	Spatial and Temporal Variability	Low	n=478 in total, no replicates.
	Metric 7:	Exposure Scenario	High	Data closely represent relevant exposure scenarios related to phthalates.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics (mean, geometric mean, median, range, 95th percentile).
	Metric 9:	Quality Assurance	High	Well described QA/QC techniques.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Characterized variability, limited discussion of uncertainties and limitations.

Overall Quality Determination   High

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

HERO ID: 2914670

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

Overall Quality Determination   Medium

| **Study Citation:** | Dallongeville, A., Costet, N., Zmirou-Navier, D., Le Bot, B., Chevrier, C., Deguen, S., Annesi-Maesano, I., Blanchard, O. (2016). Volatile and semi-volatile organic compounds of respiratory health relevance in French dwellings. Indoor Air 26(3):426-438. |
| **HERO ID:** | 2918731 |

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Supporting Information available in online version of article and in Mercier et al. (2014).
	Metric 2:	Analytical Methodology	High	PLE extraction; GC/MS (Mercier et al. 2014), calibration.
	Metric 3:	Biomarker Selection	N/A	Paper measures concentration of parent compound in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	France, western; Brittany.
	Metric 5:	Currency	Medium	September 2012 to October 2013.
	Metric 6:	Spatial and Temporal Variability	High	150 homes; 81 sampled cold season; 69 sampled hot season. Living room air continuously collected over 5 days for total of 14 m3 per dwelling.
	Metric 7:	Exposure Scenario	High	Indoor air; living room; single family homes with children.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Reported n, LOQ, detection frequency, mean, median, max, min, and 10th and 90th percentiles.
	Metric 9:	Quality Assurance	High	Field blanks, lab blanks, five calibration solutions per compound.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Limitation of one 5-day sampling event per dwelling discussed; influence of other factors evaluated.

Overall Quality Determination   High

Study Citation:			Stelmach, I., Majak, P., Jerzynska, J., Podlecka, D., Stelmach, W., Polańska, K., Ligocka, D., Hanke, W. (2015). The effect of prenatal exposure to phthalates on food allergy and early eczema in inner-city children. Allergy and Asthma Proceedings 36(4):72-78.
HERO ID:			2919070

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Spot urine samples were collected into polyethylene cups and stored at-20°C until analysis, which was performed at Nofer Institute of Occupational Medicine, Lodz, Poland. Reference was included for complete reporting on recruitment and follow-up procedures.
	Metric 2:	Analytical Methodology	Low	Phthalate metabolites in urine were determined by the use of High Performance Liquid Chromatography with tandem mass spectrometry system. LODs or LOQs were not reported
	Metric 3:	Biomarker Selection	High	MiBP is a specific metabolite of DIBP.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was performed in Poland.
	Metric 5:	Currency	Medium	Samples were collected in 2007.
	Metric 6:	Spatial and Temporal Variability	Medium	There were 147 participants, and no replicates were reported.
	Metric 7:	Exposure Scenario	High	This is a biomonitoring study that assumes exposure occurred.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual data points were not reported.
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not thoroughly discussed. Authors mentioned that they obtained two control urine samples from Consortium to Perform Human Biomonitoring on a European Scale, Work Package 3.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Key limitations reported. Variance reported as percentiles.

Overall Quality Determination   **Medium**

Study Citation:	Cesar, A., Lia, L. R. B., Pereira, C. D. S., Santos, A. R., Cortez, F. S., Choueri, R. B., De Orte, M. R., Rachid, B. R. F. (2014). Environmental assessment of dredged sediment in the major Latin American seaport (Santos, Sao Paulo - Brazil): An integrated approach. Science of the Total Environment 497:679-687.		
HERO ID:	2922317		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	The study authors reported most necessary sampling methods, including equipment, procedure, site and sample storage conditions.
Metric 2:	Analytical Methodology	High	Analytical methods for chlorinated hydrocarbons were determined by gas chromatography with the chlorines determined using an electron capture detector (USEPA 5021 CG/ECD method). Phthalates were determined by gas chromatography coupled to mass spectrometry (GC/MS) according to the US EPA 8270 method after ultrasonic extraction by the US EPA 3550C method. Detection limits reported in Table S1.
Metric 3:	Biomarker Selection	N/A	Measuring chemicals in environmental setting.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	The study was conducted in in Brazil (Sao Paulo and Santos).
Metric 5:	Currency	Medium	The study was conducted in 2007.
Metric 6:	Spatial and Temporal Variability	Medium	There were nine samples collected and no replicates collected.
Metric 7:	Exposure Scenario	Medium	The study measured concentrations in sediment disposal area in a bay. There is little information on the exposed populations.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Raw data were reported by the study authors. Summary statistics not reported.
Metric 9:	Quality Assurance	Low	QA not directly reported but can be inferred from the protocol.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	Variability, gaps, limitations and uncertainties not reported.

Overall Quality Determination   Medium

Study Citation:	Gascon, M., Valvi, D., Forns, J., Casas, M., Martínez, D., Júlvez, J., Monfort, N., Ventura, R., Sunyer, J., Vrijheid, M. (2015). Prenatal exposure to phthalates and neuropsychological development during childhood. International Journal of Hygiene and Environmental Health 218(6):550-558.		
HERO ID:	2965922		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Medium. Most key criteria met, project methodology referenced; lack of duration of sample storage data and equipment used.
Metric 2:	Analytical Methodology	Medium	Medium. Most key criteria met. The LOD for the different congeners ranged from 0.5 to 1 g/L (further details for methodology referenced in Valvi et al., 2015).
Metric 3:	Biomarker Selection	Medium	MiBP is calculated as a sum of four DEHP metabolites.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	High. Samples provided by participants in a hospital in Spain.
Metric 5:	Currency	Medium	Low. Samples collected 2004-2006.
Metric 6:	Spatial and Temporal Variability	Low	Medium. Two spot urine specimens provided by each participant at 12 and 32 weeks gestation for n=657 participants.
Metric 7:	Exposure Scenario	High	Exposure to children.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Low	Only provides 95% CI. Lack of raw data and other summary statistics.
Metric 9:	Quality Assurance	Low	Low. Quality assurance parameters not reported, however study methods referenced.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Medium. Variability characterized within exposure concentration result summary statistics, robust discussion of potential study limitations and uncertainties.

Overall Quality Determination   Medium

Study Citation:	Takeuchi, S., Tanaka-Kagawa, T., Saito, I., Kojima, H., Jin, K., Satoh, M., Kobayashi, S., Jinno, H. (2015). Differential determination of plasticizers and organophosphorus flame retardants in residential indoor air in Japan. Environmental Science and Pollution Research 25(8):7113-7120.		
HERO ID:	3005686		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	The indoor air and dust sampling methods were described but didn't include details about storage conditions.
	Metric 2: Analytical Methodology	Medium	The analytical methods were described, including LOD. Limited details about recoveries were reported.
	Metric 3: Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	The samples were collected in in Japan.
	Metric 5: Currency	Medium	The sampling was performed during October 2013and January 2014.
	Metric 6: Spatial and Temporal Variability	Low	n=19 for dust samples, 21 for indoor air samples. No replicates.
	Metric 7: Exposure Scenario	Medium	The data likely represent relevant exposure scenarios related to indoor air and dust in Japanese dwellings, but the small sample size limits the results' generalizability.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Only summary statistics were reported, without individual sample concentrations.
	Metric 9: Quality Assurance	High	QA/QC techniques were described, including the use of field and laboratory blanks.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Variability was not characterized. Uncertainties were briefly discussed.

Overall Quality Determination   Medium

Study Citation:	O'Connell, G., Colard, S., Cahours, X., Pritchard, J. D. (2015). An Assessment of Indoor Air Quality before, during and after Unrestricted Use of E-Cigarettes in a Small Room. International Journal of Environmental Research and Public Health 12(5):4889-4907.		
HERO ID:	3011067		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	The sampling equipment used in this study was reported as were the procedures. Some methods were not reported such as sampler calibration and sample storage conditions.
Metric 2:	Analytical Methodology	Medium	The limit of detection was reported (9 mg/m^3). Recovery samples were not reported in this study.
Metric 3:	Biomarker Selection	N/A	This metric was not applicable to the data source.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	The study was conducted in the United Kingdom.
Metric 5:	Currency	Low	The study was published in 2015 but there was no date of data collection that was reported.
Metric 6:	Spatial and Temporal Variability	Low	Less than five samples were collected (4 total) and there were no replicates that were collected.
Metric 7:	Exposure Scenario	High	The exposure scenario was characterized because this was a controlled study. The type of product used was characterized (E-cigarettes) meaning the source of exposure was known and the method of application.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	High	Raw data were reported in this study in Table 1.
Metric 9:	Quality Assurance	Medium	Limited QA was reported.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Limitations were reported.

Overall Quality Determination   Medium

Study Citation:		Bi, X., Yuan, S., Pan, X., Winstead, C., Wang, Q. (2015). Comparison, association, and risk assessment of phthalates in floor dust at different indoor environments in Delaware, USA. Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 50(14):1428-1439.	
HERO ID:		3019857	

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Sampling methods described sites, equipment, care to avoid cross-contamination, storage, and more.
	Metric 2: Analytical Methodology	High	Analytical methodology described sample preparation, extraction, instrumentation, LODs, and more.
	Metric 3: Biomarker Selection	N/A	Study measured parent chemicals in indoor dust.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Samples were collected in Dover, Delaware.
	Metric 5: Currency	Medium	Data were collected in 2013.
	Metric 6: Spatial and Temporal Variability	Medium	A total of 44 samples were collected without replicates.
	Metric 7: Exposure Scenario	High	Exposure to dust from different indoor environments is relevant.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	No raw data were provided but summary statistics were complete.
	Metric 9: Quality Assurance	High	There was robust reporting of QA/QC, including triplicate analysis of each sample and acceptable recoveries.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Summary statistics were complete but gaps or limitations were only briefly reported.

Overall Quality Determination   High

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: Shi, W., Deng, D., Wang, Y., Hu, G., Guo, J., Zhang, X., Wang, X., Giesy, J. P., Yu, H., Wang, Z. (2015). Causes of endocrine disrupting potencies in surface water in East China. Chemosphere 144:1435-1442.

HERO ID: 3045459

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Scientifically sound, well described methodology that includes site characteristics, sampling equipment, and storage conditions.
	Metric 2:	Analytical Methodology	Medium	LOQs and recoveries were reported, but limited information on instrument calibration.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study conducted in China.
	Metric 5:	Currency	Medium	Samples were collected in 2011.
	Metric 6:	Spatial and Temporal Variability	Medium	Samples were collected from 12 locations of 20L each without replicates.
	Metric 7:	Exposure Scenario	Medium	There was limited information on the population and microenvironment of interest.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations were reported but most summary statistics were missing.
	Metric 9:	Quality Assurance	Medium	There was limited reporting of QA/QC techniques.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	There was no characterization of variance (although raw data were provided) and discussion of uncertainties and limitations.

Overall Quality Determination   **Medium**

Study Citation:	Den Hond, E., Tournaye, H., De Sutter, P., Ombelet, W., Baeyens, W., Covaci, A., Cox, B., Nawrot, T. S., Van Larebeke, N., D'Hooghe, T. (2015). Human exposure to endocrine disrupting chemicals and fertility: A case-control study in male subfertility patients. Environment International 84:154-160.		
HERO ID:	3045496		

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	Low	Low. Details described in Angerer (2008). LOQ's not reported.
	Metric 3:	Biomarker Selection	High	High. Sampling for metabolites specific for parent chemicals (MiBP).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	High. Belgium.
	Metric 5:	Currency	Low	Low. No sampling dates, publication date 2015.
	Metric 6:	Spatial and Temporal Variability	Medium	Medium. Single spot urine samples from each of 163 men, non-statistical sampling method. No replicates.
	Metric 7:	Exposure Scenario	Medium	Medium. Participant characteristics reported, lack of baseline/control samples.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Medium. Exposure levels and mean reported, lack of detection frequency and raw data.
	Metric 9:	Quality Assurance	Low	Some quality assurance procedures in sampling equipment and standard procedures. Lack of recovery data and blanks.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variability summarized within statistical summary measures, study limitations discussed.

Overall Quality Determination   **Medium**

Study Citation:	Starling, A. P., Engel, L. S., Calafat, A. M., Koutros, S., Satagopan, J. M., Yang, G., Matthews, C. E., Cai, Q., Buckley, J. P., Ji, B. T., Cai, H., Chow, W. H., Zheng, W., Gao, Y. T., Rothman, N., Xiang, Y. B., Shu, X. O. (2015). Predictors and long-term reproducibility of urinary phthalate metabolites in middle-aged men and women living in urban Shanghai. Environment International 84:94-106.		
HERO ID:	3045503		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Enrollment described, timing of samples, containers and storage described.
Metric 2:	Analytical Methodology	Low	CDC lab performed analyses; previously published laboratorymethods (Kato et al., 2005; Silva et al., 2008), LOD provided.
Metric 3:	Biomarker Selection	High	Metabolite in urine.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	China.
Metric 5:	Currency	Low	Women samples from 1997-2000 and men from 2006-2007.
Metric 6:	Spatial and Temporal Variability	Medium	n = 50 men and 50 women, no replicates.
Metric 7:	Exposure Scenario	High	Biomonitoring.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	GM, 5th, 95th, % below LOD.
Metric 9:	Quality Assurance	Medium	Ten blinded, pooled quality control samples were also included along with the subject samples.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Variability discussed, uncertainty included in percentiles.

Overall Quality Determination   Medium

Study Citation:	Mu, D., Gao, F., Fan, Z., Shen, H., Peng, H., Hu, J. (2015). Levels of phthalate metabolites in urine of pregnant women and risk of clinical pregnancy loss. Environmental Science & Technology 49(17):10651-10657.		
HERO ID:	3045505		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Control group and woman who underwent clinical pregnancy loss from Beijing, China. One sample per woman, sample storage and analysis characteristics well described.
Metric 2:	Analytical Methodology	High	Extraction methods, analytical equipment, calibration, blanks, spiked samples, LOD, LOQ all described.
Metric 3:	Biomarker Selection	High	Metabolite known to be derived from parent chemical (MiBP).
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Beijing, China
Metric 5:	Currency	Medium	September 2011 to June 2014
Metric 6:	Spatial and Temporal Variability	Medium	One sample per woman, individually analyzed, 304 samples in total. No replicates. Morning urine samples.
Metric 7:	Exposure Scenario	High	Exposure to pregnant women.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	No raw data reported. Percent of samples > LOD, median, P5, P95 and Concentration Ranges within the 1st, 2nd, 3rd and 4th Quartiles reported for MEP, MiBP, and MnBP.
Metric 9:	Quality Assurance	High	Blanks, spiked samples at 2 levels. The recoveries for all target chemicals ranged from 75.7 to 90.1%, and limits of detection (LODs) and limits of quantitation (LOQs) were $0.1-0.27$ and $0.3-0.7$ μg/L, respectively.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	The study mentions limitations such as a single urine sample was measured in this study, which would lead to considerable day-to-day variation.

Overall Quality Determination   **High**

Study Citation: **HERO ID:**	Huygh, J., Clotman, K., Malarvannan, G., Covaci, A., Schepens, T., Verbrugghe, W., Dirinck, E., Van Gaal, L., Jorens, P. G. (2015). Considerable exposure to the endocrine disrupting chemicals phthalates and bisphenol-A in intensive care unit (ICU) patients. Environment International 81:64-72. 3045532		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Most key criteria are met except duration of sample storage.
Metric 2:	Analytical Methodology	High	Key criteria are met. LOQs and recoveries were reported in supplemental material.
Metric 3:	Biomarker Selection	High	Metabolites are specific for parent chemical.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Study was conducted in Belgium.
Metric 5:	Currency	Low	Sampling dates not reported for ICU patients. (Control patient data were collected from previously recruited persons during a 2009-2012 study. Publication date is 2015.
Metric 6:	Spatial and Temporal Variability	Medium	Multiple repeated samples were collected up to 4 days for each of 35 ICU patients for spot urine and serum. This is not a non-statistical sampling methods and no replicates were reported).
Metric 7:	Exposure Scenario	High	Participant characteristics reported. Data from control population were provided. Stratification was done by potential source ICU equipment for relevant exposure scenario.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Most key criteria were met. Frequency of detection reported in supplemental material. Raw data were missing.
Metric 9:	Quality Assurance	Low	QA parameters, such as participation in interlaboratory comparison, were described. However, authors identified potential issues: potential for renal insufficiency influencing urinary results and contamination of serum MEHP.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Variability described in statistical summary measures. There was some discussion of potential study limitations in Section 4.2.

Overall Quality Determination   **Medium**

Study Citation:	Dewalque, L., Pirard, C., Vandepaer, S., Charlier, C. (2015). Temporal variability of urinary concentrations of phthalate metabolites, parabens and benzophenone-3 in a Belgian adult population. Environmental Research 142:414-423.		
HERO ID:	3045602		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Urine samples collection and population described. Participants from previous study (Dewalqueetal.,2014a); limited details about urine sampling were enough to deem it reliable.
	Metric 2: Analytical Methodology	Low	The analytical procedure, consisting an enzymatic hydrolysis and a solid phase extraction followed by liquid chromatography tandem mass spectrometry, has been previously described (Dewalqueetal., 2014c). Missing QA/QC details and LODs
	Metric 3: Biomarker Selection	High	metabolite in urine
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Belgium
	Metric 5: Currency	Medium	2013
	Metric 6: Spatial and Temporal Variability	Medium	32 adults, 351 samples, no replicates
	Metric 7: Exposure Scenario	High	biomonitoring
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Table S2: GM, 95%CI, 50th, 95th min, max
	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:	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:	Myridakis, A., Chalkiadaki, G., Fotou, M., Kogevinas, M., Chatzi, L., Stephanou, E. G. (2016). Exposure of preschool-age Greek children (RHEA Cohort) to bisphenol A, parabens, phthalates, and organophosphates. Environmental Science & Technology 50(2):932-941.		
HERO ID:	3070749		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Medium. Most key criteria met. Lack of duration of sample storage data.
Metric 2:	Analytical Methodology	Medium	Medium. Most key criteria met, mLOD's reported in Table 1, lack of recovery data.
Metric 3:	Biomarker Selection	High	High. Sampling for metabolites specific for parent chemical of interest
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	High. Samples provided by participants in Heraklion, Crete, Greece.
Metric 5:	Currency	Medium	Medium. Sampling dates for children not provided, but inferred from text as approximately 2008-2012, publication date 2015.
Metric 6:	Spatial and Temporal Variability	Medium	Medium. Spot urine samples obtained from children at 4 years of age, total of n=500 samples collected from 500 children randomly selected from n=800 volunteers.
Metric 7:	Exposure Scenario	High	High. Potential exposure sources explored within principal component analysis, participant characteristics described.
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 procedures described, most key criteria met; lack of recovery data.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Medium. Variability characterized within summary statistics, robust discussion of potential reasons for mixed results in comparisons with previous studies.

Overall Quality Determination   **Medium**

	Study Citation:	Gomez Ramos, M. J., Heffernan, A. L., Toms, L. M., Calafat, A. M., Ye, X., Hobson, P., Broomhall, S., Mueller, J. F. (2016). Concentrations of phthalates and DINCH metabolites in pooled urine from Queensland, Australia. Environment International 88(Elsevier):179-186.		
	HERO ID:	3070900		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Surplus stored urine samples, pooled, could have been collected any time of day.
	Metric 2:	Analytical Methodology	Medium	Analyses performed by CDC, LOD provided. Analysis was done using solid phase extraction-high performance liquid chromatography isotope dilution tandem mass spectrometry as described previously (Silva et al., 2007a). QA/QC was performed but not reported.
	Metric 3:	Biomarker Selection	High	Metabolite in urine.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Australia.
	Metric 5:	Currency	Medium	2012-2013.
	Metric 6:	Spatial and Temporal Variability	Low	24 pooled samples of 100 urine samples; urine collection varied.
	Metric 7:	Exposure Scenario	High	Biomonitoring.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data from pooled samples in Table 2.
	Metric 9:	Quality Assurance	Low	QC not discussed, no obvious concerns.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability captured from 24 different pools; uncertainty not discussed, no obvious concerns.

Overall Quality Determination   Medium

| 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 (MiBP).
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:	Gong, M., Weschler, C. J., Zhang, Y. (2016). Impact of clothing on dermal exposure to phthalates: Observations and insights from sampling both skin and clothing. Environmental Science & Technology 50(8):4350-4357.		
HERO ID:	3229677		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Wipe procedure described and diagramed
	Metric 2:	Analytical Methodology	Low	"analyzed using methods similar to those described in previous study (41)" no other details; no LOD
	Metric 3:	Biomarker Selection	N/A	parent in dermal wipe
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	Medium	November 2014 for winter samples (this study) and June-July 2013 for the summer study samples (reported in Gong, M. Y.; Weschler, C. J.; Liu, L. P.; Shen, H. Q.; Huang, L. H.; Sundell, J.; Zhang, Y. P. Phthalate metabolites in urine samples from Beijing children and correlations with phthalate levels in their handwipes. Indoor Air 2015, 25 (6), 572−581.
	Metric 6:	Spatial and Temporal Variability	Medium	n = 11, no replicates
	Metric 7:	Exposure Scenario	High	Dermal exposure from clothing.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	mean, range, 50th, 75th
	Metric 9:	Quality Assurance	Low	QA not discussed, no obvious concerns
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	uncertainty not discussed; variability discussed with respect to clothing versus skin and time of year

Overall Quality Determination   Medium

| | Study Citation: | Raffy, G., Mercier, F., Blanchard, O., Derbez, M., Dassonville, C., Bonvallot, N., Glorennec, P., Le Bot, B. (2016). Semi-volatile organic compounds in the air and dust of 30 French schools: A pilot study. Indoor Air 27(1):114-127. |
| | HERO ID: | 3229681 |

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Air sampling described; methods for dust sampling described in SI and in Blanchard et al. (2014).
	Metric 2:	Analytical Methodology	High	Details provided in SI, Mercier et al. (2014), and Blanchard et al. (2014). PLE and GC/MS; 5-level calibration; LOQs; field and lab blanks, and QA samples and recoveries.
	Metric 3:	Biomarker Selection	N/A	Air and dust sampling
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Brittany, France
	Metric 5:	Currency	Medium	2009 to 2010
	Metric 6:	Spatial and Temporal Variability	Medium	33 schools, 3 rooms per school, Air: single 4.5-day continuous sample/room, 1 field blank/school; Dust 1 vacuum per room and 3 damp wipes per room.
	Metric 7:	Exposure Scenario	High	School classrooms: air and dust samples.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	5th, 50th, and 95th percentiles (no mean, no variance); N, freq. of detect, LOQ and upper limit of calibration reported.
	Metric 9:	Quality Assurance	High	Well described in text and SI and includes recovery calculation, running blanks and QC samples
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Discussed analytic issues, uncertainties, possible confounding factors, and excluded data. Variation within and across schools not discussed.

Overall Quality Determination　　　　　　High

Study Citation:	Braouezec, C., Enriquez, B., Blanchard, M., Chevreuil, M., Teil, M. J. (2016). Cat serum contamination by phthalates, PCBs, and PBDEs versus food and indoor air. Environmental Science and Pollution Research 23(10):9574-9584.		
HERO ID:	3229683		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Air, cat blood serum, cat food. Missing air sampling time intervals, seems the air sample was for 3 periods of 2 weeks each. Unclear if they sample cat serum every 12 hours for the same period they collected air samples. Approaches to avoid contamination not included. Description of sampling space provided but missing key details. Controlled environment was set up to mimic indoor, not completely described to fully assess/characterize sources of the chemicals, such as building materials, consumer products present, and others. This scenario is mainly to assess cat related products and food as sources.
	Metric 2:	Analytical Methodology	High	Extraction, fractionation, purification, analyses, methods quality controls, detection limit range.
	Metric 3:	Biomarker Selection	N/A	Measured parent chemical in blood serum.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	France
	Metric 5:	Currency	Low	Sampling date not provided, published 2016.
	Metric 6:	Spatial and Temporal Variability	Low	8 cats; indoor air (missing collection and food sample size not shown).
	Metric 7:	Exposure Scenario	Medium	Indoor air at University Pierre et Marie Curie. Scenario may be used for cat products emissions and cat food background levels. However, is missing a better description of materials present in the control indoor environment.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1 individual data points available for serum for 8 cats; Figure 1 food and air graphs.
	Metric 9:	Quality Assurance	High	Lab blanks, IDL, LOQ, recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability and uncertainty not discussed, no obvious concerns. Sources of uncertainty and variability from cross contamination, and materials within the indoor environment missing.

Overall Quality Determination   Medium

| | Study Citation: | Shoaff, J. R., Romano, M. E., Yolton, K., Lanphear, B. P., Calafat, A. M., Braun, J. M. (2016). Prenatal phthalate exposure and infant size at birth and gestational duration. Environmental Research 150(Elsevier):52-58. |
| | HERO ID: | 3230353 |

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology included information of participant characteristics, equipment, storage, and more.
	Metric 2:	Analytical Methodology	Low	Authors cited previously published analytical methods without any further details. LODs provided as a range for all metabolites combined.
	Metric 3:	Biomarker Selection	High	MiBP is specific to DiBP.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study participants were from Cincinnati, Ohio.
	Metric 5:	Currency	Medium	Participant recruitment occurred between 2003 and 2006.
	Metric 6:	Spatial and Temporal Variability	Low	Sample size consisted of 368 infant pairs. Two spot samples were collected at different points in gestation.
	Metric 7:	Exposure Scenario	High	This is a biomonitoring study where mothers were exposed through the prevalence of phthalates and children in-utero.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data were provided.
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not described.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variance was characterized but discussion of uncertainties and limitations was mostly absent.

Overall Quality Determination   **Medium**

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

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

Overall Quality Determination   High

Study Citation:	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: | Mandin, C., Mercier, F., Rarnalho, O., Lucas, J. P., Gilles, E., Blanchard, O., Bonvallot, N., Glorennec, P., Le Bot, B. (2016). Semi-volatile organic compounds in the particulate phase in dwellings: A nationwide survey in France. Atmospheric Environment 136:82-94. |
| **HERO ID:** | 3230506 |

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling is detailed in Section 2.1.
	Metric 2:	Analytical Methodology	Medium	no recovery samples, but analytical method was previously validated
	Metric 3:	Biomarker Selection	N/A	Biomarkers were not assessed nor relevant for this study.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	This study was located in France.
	Metric 5:	Currency	Medium	sampling took place from October 2003 to December 2005
	Metric 6:	Spatial and Temporal Variability	Medium	no replicate samples, but used continuous air sampling methods over a period of one-week
	Metric 7:	Exposure Scenario	Medium	limited characterization of building characteristics and other microenvironmental factors
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	no raw data reported
	Metric 9:	Quality Assurance	Medium	no recovery samples, but used field blank samples; the analytical method was previously validated; no issues were identified
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	no discussion of limitations or data uncertainties

Overall Quality Determination   Medium

| Study Citation: | Laborie, S., Moreau-Guigon, E., Alliot, F., Desportes, A., Oziol, L., Chevreuil, M. (2016). A new analytical protocol for the determination of 62 endocrine-disrupting compounds in indoor air. Talanta 147:132-141. |
| HERO ID: | 3230514 |

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Sampling procedure, matrix characterization were described in detail. The study lacked a few details about storage conditions.
	Metric 2: Analytical Methodology	High	TBBPA was analyzed by LC/MA; the other chemicals were analyzed by GC/MS. LOD was reported in SI.
	Metric 3: Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	4 indoor environments in Paris.
	Metric 5: Currency	Medium	2013
	Metric 6: Spatial and Temporal Variability	Low	The samples came from 4 indoor environments.
	Metric 7: Exposure Scenario	High	Indoor air
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Average concentrations were reported in Table 5.
	Metric 9: Quality Assurance	Low	Quality assurance was not directly discussed but assumed.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	The main discussion on limitation and variability were about the analytical method.

Overall Quality Determination   Medium

Study Citation:	Lenoir, A., Boulay, R., Dejean, A., Touchard, A., Cuvillier-Hot, V. (2016). Phthalate pollution in an Amazonian rainforest. Environmental Science and Pollution Research 23(16):16865-16872.
HERO ID:	3350198

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling sites were shown and characterized. Some methods were explained, but missing information about sample storage conditions.
	Metric 2:	Analytical Methodology	Low	LOD/LOQs were not reported.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in ants.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was conducted in French Guiana.
	Metric 5:	Currency	Medium	Samples were collected in 2013.
	Metric 6:	Spatial and Temporal Variability	Medium	Nearly 300 ants were samples without replicates.
	Metric 7:	Exposure Scenario	High	Sources of phthalate exposures to ants in pristine environments were described.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data were provided.
	Metric 9:	Quality Assurance	Medium	Some discussion of QA/QC techniques was provided.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variance not characterized, and uncertainties/limitations were not described.

Overall Quality Determination   **Medium**

Study Citation:	Watkins, D. J., Milewski, S., Domino, S. E., Meeker, J. D., Padmanabhan, V. (2016). Maternal phthalate exposure during early pregnancy and at delivery in relation to gestational age and size at birth: A preliminary analysis. Reproductive Toxicology 65:59-66.		
HERO ID:	3350206		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Some methods not reported such as sample storage conditions and sampler calibration.
Metric 2:	Analytical Methodology	High	Key analytical methods reported.
Metric 3:	Biomarker Selection	High	Acceptable biomarker.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	USA
Metric 5:	Currency	Medium	Samples collected between 2009 and 2012.
Metric 6:	Spatial and Temporal Variability	High	>10 samples; with 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	High	Gaps and limitations reported.

Overall Quality Determination   High

Study Citation: Pan, Y., Jing, J., Yeung, L. W., Sheng, N., Zhang, H., Yao, B., Dai, J. (2016). Associations of urinary 5-methyl-2'-deoxycytidine and 5-hydroxymethyl-2'-deoxycytidine with phthalate exposure and semen quality in 562 Chinese adult men. Environment International 94:583-590.

HERO ID: 3350210

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Key sampling methods reported. Sampling approaches described, materials, and population description described.
Metric 2:	Analytical Methodology	High	key analytical methods reported
Metric 3:	Biomarker Selection	High	Acceptable biomarker
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	China
Metric 5:	Currency	Medium	Samples collected between 2014 and 2015
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	Analytical QA reported, more details in supplemental.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Gaps and limitations reported

Overall Quality Determination   High

Study Citation:	Ferguson, K. K., Meeker, J. D., Cantonwine, D. E., Chen, Y. H., Mukherjee, B., Mcelrath, T. F. (2016). Urinary phthalate metabolite and bisphenol A associations with ultrasound and delivery indices of fetal growth. Environment International 94(Elsevier):531-537.		
HERO ID:	3350218		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Some sampling methods not reported such as sample storage conditions and sampler calibration
	Metric 2: Analytical Methodology	High	Key analytical methods reported
	Metric 3: Biomarker Selection	High	Acceptable biomarker
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Boston, MA
	Metric 5: Currency	Medium	Samples collected from 2006 to 2012
	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	Some limitations reported

Overall Quality Determination Medium

Study Citation:	Li, B., Liu, R., Gao, H., Tan, R., Zeng, P., Song, Y. (2016). Spatial distribution and ecological risk assessment of phthalic acid esters and phenols in surface sediment from urban rivers in Northeast China. Environmental Pollution 219(Elsevier):409-415.		
HERO ID:	3350247		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Some sampling methods not reported such as phthalate free materials for sampling and measures to avoid contamination. Also missing sediment sample collection depth, and thickness or collected layer. Sampling locations and plan was described, Figure 1, upstream and downstream from main sources.
Metric 2:	Analytical Methodology	High	Key analytical methods reported, gas chromatograph (GC) coupled with mass selective detector (MSD). LOD reported along with analytical QA/QC samples, blanks, recoveries, and internal standards.
Metric 3:	Biomarker Selection	N/A	N/A - river sediment samples no biomarker needed.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	China
Metric 5:	Currency	Medium	Samples collected in 2014
Metric 6:	Spatial and Temporal Variability	Medium	Seven and 9 samples in from two rivers at various locations upstream and downstream; no replicates
Metric 7:	Exposure Scenario	Medium	Urban river sediments upstream and downstream from sources.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Raw data not reported
Metric 9:	Quality Assurance	High	Analytical QA/QC parameters reported and reliable.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported. Sources of uncertainty and variability are discussed within the goals of the study, however source attribution and other risk evaluation approaches could have been further explored.

Overall Quality Determination　　　　　　Medium

Study Citation:	Strømmen, K., Lyche, J. L., Blakstad, E. W., Moltu, S. J., Veierød, M. B., Almaas, A. N., Sakhi, A. K., Thomsen, C., Nakstad, B., Brække, K., Rønnestad, A. E., Drevon, C. A., Iversen, P. O. (2016). Increased levels of phthalates in very low birth weight infants with septicemia and bronchopulmonary dysplasia. Environment International 89-90:228-234.		
HERO ID:	3350320		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The study included description of when samples were collected, how they were stored and how they were analyzed. It also included quality control samples.
	Metric 2:	Analytical Methodology	Medium	The study included internal standards, LOQ, percentages representing accuracy of the method, and, for confirmation ofphthalate metabolites, both retention time and qualifier ratio wereused. It is not completely clear how "accuracy of the method" was calculated. Analysis was by on-line column switching liquid chromatography coupled to tandem mass spectrometry.
	Metric 3:	Biomarker Selection	Medium	Metabolites were described and measured for each chemical. Samples were from urine and were not adjusted for creatinine or specific weight. Multiple metabolites were summed for compounds with multiple metabolites.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Norway
	Metric 5:	Currency	Medium	The study was conducted in 2010.
	Metric 6:	Spatial and Temporal Variability	Low	While there were more than 110 samples, collected in weeks 1, 3, and 5 of life (approx. 35 in each timeframe), they were un-pooled urine spot samples.
	Metric 7:	Exposure Scenario	High	The data closely represent a relevant exposure scenario - no concerns were found.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data were provided, only geometric means, medians, minima, maxima and LOQ.
	Metric 9:	Quality Assurance	Low	QA/QC discussed was limited to a reference to quality control samples; reported ranges of "accuracies of the method," and using both retention time and qualifier ratio to confirm phthalate metabolites).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No discussion of variability or uncertainty was included. Some degree of variability was shown by minimum and maximum detection of urinary phthalate metabolites, but standard deviations are absent.

Overall Quality Determination   Medium

Study Citation:	Eremina, N., Paschke, A., Mazlova, E. A., Schüürmann, G. (2016). Distribution of polychlorinated biphenyls, phthalic acid esters, polycyclic aromatic hydrocarbons and organochlorine substances in the Moscow River, Russia. Environmental Pollution 210:409-418.		
HERO ID:	3350341		

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	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Moscow River, Russia
Metric 5:	Currency	Medium	Samples collected October 2013.
Metric 6:	Spatial and Temporal Variability	Low	<5 samples; no replicates
Metric 7:	Exposure Scenario	Medium	Exposure source not well characterized.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	High	Individual sample concentrations and statistics reported.
Metric 9:	Quality Assurance	High	Key QA reported.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Limited gaps and limitations reported.

Overall Quality Determination   Medium

Study Citation: Botton, J., Philippat, C., Calafat, A. M., Carles, S., Charles, M. A., Slama, R. (2016). Phthalate pregnancy exposure and male offspring growth from the intra-uterine period to five years of age. Environmental Research 151:601-609.

HERO ID: 3444888

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Participant selection described previously, urine collection described.
	Metric 2:	Analytical Methodology	Medium	LOD provided, analyses performed by CDC.
	Metric 3:	Biomarker Selection	High	Metabolite in urine.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	France
	Metric 5:	Currency	Low	2003-2006
	Metric 6:	Spatial and Temporal Variability	Medium	n = 520, no replicates.
	Metric 7:	Exposure Scenario	High	Biomonitoring
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	5th, 25th, 50th, 75th, 95th standardized and non-standardized concentrations 5th, 50th, and 95th included.
	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:	Giovanoulis, G., Alves, A., Papadopoulou, E., Cousins, A. P., Schütze, A., Koch, H. M., Haug, L. S., Covaci, A., Magnér, J., Voorspoels, S. (2016). Evaluation of exposure to phthalate esters and DINCH in urine and nails from a Norwegian study population. Environmental Research 151:80-90.		
HERO ID:	3455194		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Sampling was only briefly described, but reference to previous study (Papadopoulou et al., 2016) was provided.
Metric 2:	Analytical Methodology	High	Pertinent analytical methods (e.g., extraction, instrumentation, LOQs) were provided in both main paper and SI.
Metric 3:	Biomarker Selection	High	Metabolite is specific to DiBP.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Study was conducted in Norway.
Metric 5:	Currency	Medium	Samples were collected during 2013-2014.
Metric 6:	Spatial and Temporal Variability	Low	About 60 samples were collected without replicates, and unpooled spot urine samples were analyzed.
Metric 7:	Exposure Scenario	High	This is a biomonitoring study where exposure is presumed to occur via numerous consumer products.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Raw data were not provided.
Metric 9:	Quality Assurance	Low	Only some QA (e.g., spike and blank samples) were discussed in SI.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Uncertainties, limitations, and gaps were not discussed.

Overall Quality Determination   Medium

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:	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:	Dereumeaux, C., Saoudi, A., Pecheux, M., Berat, B., de Crouy-Chanel, P., Zaros, C., Brunel, S., Delamaire, C., le Tertre, A., Lefranc, A., Vandentorren, S., Guldner, L. (2016). Biomarkers of exposure to environmental contaminants in French pregnant women from the Elfe cohort in 2011. Environment International 97:56-67.		
HERO ID:	3469298		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Samples were collected according to the protocols defined and validated by a pilot study in 2007, including materials and storage conditions.
	Metric 2: Analytical Methodology	High	Analytical method, LOD, LOQ and Intra day precision are reported in Table 2. Instrument provided also. Analytical performances of biomarker measurements realized in the perinatal component of the French HBM program.
	Metric 3: Biomarker Selection	High	The biomarkers were selected owing to the biomonitoring feasibility, the exposure relevance, the existing regulations for the compounds, and the priorities in terms of health effects.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	National scale monitoring in France.
	Metric 5: Currency	Medium	2011
	Metric 6: Spatial and Temporal Variability	Medium	Large sample size, sampling from June to November. No sample replicates. Spot urine samples taken.
	Metric 7: Exposure Scenario	High	The primary aim of the perinatal component of the French HBM program was to describe internal concentrations of environmental contaminants among pregnant women having given birth in continental France in 2011.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Individual sample concentrations are not reported. Descriptive statistical analyses for each biomarker included: the geometric mean, median, 25th, 75th and 95th percentiles in Table 4.
	Metric 9: Quality Assurance	Low	Laboratory blanks and QC samples (spiked samples) were introduced into each batch of samples (every 10 samples) to verify the accuracy and precision of the measurements at, at least, three concentration levels within the measurement range. No field control samples. Recoveries not reported.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	High	The study characterizes variability in the community sampled and reports weakness and limitations of the study.

Overall Quality Determination   **High**

Study Citation:	Müllerová, D., Bouchalová, V., Matějková, D., Kovářová, K., Svačina, Š., Vrbík, K., Pavloušková, J., Dvořáková, J., Müller, L. (2016). Phthalates exposure indicators determined by urinary phthalate metabolites in healthy non-obese Czech adults: FANTOM study. Food Additives & Contaminants: Part A, Chemistry, Analysis, Control, Exposure & Risk Assessment 33(12):1817-1825.		
HERO ID:	3469309		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods (e.g., participant characteristics, urine collection schedule, storage conditions) were reported.
	Metric 2:	Analytical Methodology	Low	LODs/LOQs were not reported.
	Metric 3:	Biomarker Selection	High	Metabolite is specific to DIBP.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was conducted in Czech Republic.
	Metric 5:	Currency	Medium	Samples were collected in 2013.
	Metric 6:	Spatial and Temporal Variability	Medium	Samples were collected from 201 adults without replicates.
	Metric 7:	Exposure Scenario	High	This is a biomonitoring study that aimed to characterize associations between various consumer products, fruits, and meats and urine metabolite levels.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not reported but can be implied through its use of an accredited laboratory that participated in previous quality assessments. References were provided.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations were reported.

Overall Quality Determination   Medium

Study Citation:	James-Todd, T. M., Meeker, J. D., Huang, T., Hauser, R., Ferguson, K. K., Rich-Edwards, J. W., Mcelrath, T. F., Seely, E. W. (2016). Pregnancy urinary phthalate metabolite concentrations and gestational diabetes risk factors. Environment International 96:118-126.		
HERO ID:	3469326		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	enrollment described, urine collection described
	Metric 2:	Analytical Methodology	Low	All phthalate metabolites were analyzed by National Science Foundation International, Inc. (Ann Arbor, MI) using protocol from the Centers for Disease Control and Prevention described elsewhere (Ferguson et al., 2014a; CDC. (Centers for Disease Control and Prevention), 2005). LOD not provided.
	Metric 3:	Biomarker Selection	High	metabolite in urine
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Boston, U.S.
	Metric 5:	Currency	Medium	2006-2008
	Metric 6:	Spatial and Temporal Variability	High	N = 350
	Metric 7:	Exposure Scenario	High	biomonitoring
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	GM, 25th, 75th
	Metric 9:	Quality Assurance	Low	QA not discussed, no obvious concerns
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	variability captured by different demographic groups; uncertainty not discussed, no obvious concerns

Overall Quality Determination   Medium

Study Citation:	Doherty, B. T., Engel, S. M., Buckley, J. P., Silva, M. J., Calafat, A. M., Wolff, M. S. (2017). Prenatal phthalate biomarker concentrations and performance on the Bayley Scales of Infant Development-II in a population of young urban children. Environmental Research 152(Elsevier):51-58.		
HERO ID:	3469358		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Enrollment and sample collection were described, but missing details such as equipment and collection regimen.
	Metric 2: Analytical Methodology	Medium	Analytical methods were not described but referenced publications where it was: Silva et al., 2008; Kato et al., 2005. LODs were provided.
	Metric 3: Biomarker Selection	High	Metabolite is specific to DiBP.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Study conducted in U.S. (New York).
	Metric 5: Currency	Low	Samples were collected during 1998-2002.
	Metric 6: Spatial and Temporal Variability	Low	Samples were collected from 258 participants without replicates. Spot unpooled urine samples were analyzed from mothers.
	Metric 7: Exposure Scenario	High	This is a biomonitoring study that explained possible sources of exposure, as well as population of interest.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Geometric mean, standard error, and 50th and 95th percentiles were provided but not raw data.
	Metric 9: Quality Assurance	Low	QA/QC was not discussed.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Low	Uncertainties, limitations, and gaps were not discussed.

Overall Quality Determination   Medium

Study Citation:	Saini, A., Okeme, J. O., Mark Parnis, J., Mcqueen, R. H., Diamond, M. L. (2016). From air to clothing: characterizing the accumulation of semi-volatile organic compounds to fabrics in indoor environments. Indoor Air 27(3):631-641.		
HERO ID:	3469466		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Study was missing some information such as sample matrix. Equipment for air sampling and collection intervals were described. A previously published paper was cited for further details on air sampling methods.
Metric 2:	Analytical Methodology	Low	LOD/LOQs were not provided.
Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in air and fabric.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Study was performed in Canada.
Metric 5:	Currency	Medium	Samples were collected in 2013.
Metric 6:	Spatial and Temporal Variability	Low	Fabrics were deployed in 20 homes and 5 offices. Air samples were collected weekly for up to 56 days (or 28 - unclear). The study size was unclear, but enough information was provided to infer that there more than 10 samples. Replicates were occasionally collected over the study period.
Metric 7:	Exposure Scenario	High	Exposure to phthalates via dermal contact with clothing and via inhalation of particles that partition to indoor air is relevant.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Low	Some concentration values and ranges were provided in text. Otherwise, most summary statistics and raw data were missing.
Metric 9:	Quality Assurance	Medium	Blanks, recoveries, and references to other analytical methods for reproducibility were provided. However, recoveries were not reported for most phthalates of interest.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	Variance and limitations were not presented.

Overall Quality Determination   Medium

| | | Study Citation: | Tsai, H. J., Wu, C. F., Tsai, Y. C., Huang, P. C., Chen, M. L., Wang, S. L., Chen, B. H., Chen, C. C., Wu, W. C., Hsu, P. S., Hsiung, C. A., Wu, M. T. (2016). Intake of phthalate-tainted foods and serum thyroid hormones in Taiwanese children and adolescents. Scientific Reports 6:30589. |
| | | HERO ID: | 3469519 |

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Participants in this study provided one-spot urine samples which were aliquoted and stored in a freezer until measurement. No further details on methodology or equipment for sample collection were reported, which may have an impact on results.
	Metric 2:	Analytical Methodology	Medium	The study reported following analytical methodology that has been described in detail in other cited studies. Instrumentation was reported, but other details of the method were not described. Method detection limit was reported.
	Metric 3:	Biomarker Selection	High	The monoester phthalate metabolite of the parent chemical of interest is measured in urine, which is considered a highly reliable measure of current phthalate exposure. Concentration is further corrected for urine creatinine.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	This study was conducted with participants in Taiwan.
	Metric 5:	Currency	Medium	Study participants were collected between August 2012 and January 2013.
	Metric 6:	Spatial and Temporal Variability	Low	Single spot urine samples were collected from 240 study participants. Use of replicates was not reported.
	Metric 7:	Exposure Scenario	High	This is a biomonitoring study where exposure is presumed to occur through a deliberate addition of certain phthalates to foodstuffs, after which specific event, participants sought medical consultation and responded to a questionnaire designed to estimate exposure from this event.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported. Summary statistics include minimum, median, maximum, and other percentiles of concentration of phthalate biomarker.
	Metric 9:	Quality Assurance	Low	QA/QC methods were not described but can be inferred from the use of standard laboratory protocols published in other studies.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Quantitative characterization of variability was reported by various percentiles of measured exposure. There is some discussion of limitations, including a time lag that may have resulted in recall bias when completing the exposure questionnaire. Further detail on exposure-specific limitations could have improved the score in this metric.

Overall Quality Determination   Medium

Study Citation:	Moreau-Guigon, E., Alliot, F., Gasperi, J., Blanchard, M., Teil, M. J., Mandin, C., Chevreuil, M. (2016). Seasonal fate and gas/particle partitioning of semi-volatile organic compounds in indoor and outdoor air. Atmospheric Environment 147(Elsevier):423-433.		
HERO ID:	3470397		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Key sampling methods were reported.
Metric 2:	Analytical Methodology	High	Acceptable analytical methods were 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	Samples collected in 2011 and 2012
Metric 6:	Spatial and Temporal Variability	High	6 samples per indoor environment
Metric 7:	Exposure Scenario	Medium	Exposure source was not well characterized
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Raw data were not reported
Metric 9:	Quality Assurance	High	QA was reported.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	Few gaps and limitations were reported.

Overall Quality Determination   High

Study Citation:	Chang, W. H., Wu, M. H., Pan, H. A., Guo, P. L., Lee, C. C. (2017). Semen quality and insulin-like factor 3: Associations with urinary and seminal levels of phthalate metabolites in adult males. Chemosphere 173:594-602.		
HERO ID:	3519878		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Urine, blood, and semen samples were collected from the malepartners of subfertile (n = 253) and fertile (n = 37) couples in a reproductive center in southern Taiwan. Sample collection described
	Metric 2:	Analytical Methodology	Medium	Analytical methodology used was LC-MS/MS and quality controls were driven as previously described (Chang et al., 2015), but briefly and adequately described. LOD in SI. Missing analytical QA/QC mention or brief description.
	Metric 3:	Biomarker Selection	High	metabolite in urine and semen
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Taiwan
	Metric 5:	Currency	Medium	2010-2014
	Metric 6:	Spatial and Temporal Variability	Medium	n = 37, 124, and 129, no replicates; urine samples morning void
	Metric 7:	Exposure Scenario	High	biomonitoring
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	geometric mean and geometric mean SD
	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:	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:			Chen, C. F., Chen, C. W., Ju, Y. R., Dong, C. D. (2016). Determination and assessment of phthalate esters content in sediments from Kaohsiung Harbor, Taiwan. Marine Pollution Bulletin 124(2):767-774.
HERO ID:			3540854

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

Overall Quality Determination   Medium

| Study Citation: | Tordjman, K., Grinshpan, L., Novack, L., Göen, T., Segev, D., Beacher, L., Stern, N., Berman, T. (2016). Exposure to endocrine disrupting chemicals among residents of a rural vegetarian/vegan community. Environment International 97(Elsevier):68-75. |
| **HERO ID:** | 3540861 |

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Subjects then provided a spot urine sample. All collection and storage equipment was BPA and phthalate-free. Each subject filled in a detailed 61-item health, lifestyle and eating practice questionnaire, see supplemental. Key sampling methods reported, storage and contamination avoidance reported.
	Metric 2:	Analytical Methodology	Medium	The analytical procedure consisted of a multidimensional liquidchromatography tandem mass spectrometry method (LC-MS/MS). Some analytical methods not reported, such as recovery samples. LOD reported in supplemental information.
	Metric 3:	Biomarker Selection	Medium	Acceptable biomarker
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Israel
	Metric 5:	Currency	Medium	Samples collected in 2013 and 2014
	Metric 6:	Spatial and Temporal Variability	Medium	42 Amirim residents (29 vegetarians/13 vegans; 24 women/18men; no replicates
	Metric 7:	Exposure Scenario	Medium	Exposure to phthalates from diet, although other sources 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. Some reported in the text and supplemental information, but missing calibration, recoveries, blanks.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Key limitations reported

Overall Quality Determination   Medium

Study Citation:	Albar, H., Ali, N., Shahzad, K., Ismail, I. M. I., Rashid, M. I., Wang, W.,ei, Ali, L. N., Eqani, S. (2017). Phthalate esters in settled dust of different indoor microenvironments; Source of non-dietary human exposure. Microchemical Journal 132:227-232.		
HERO ID:	3859024		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Dust samples collected from three different microenvironments (cars, air conditioner (AC) filters and house-hold floor dust) of Saudi Arabia (KSA) and Kuwait. Used vacuum cleaner to collect dust samples. Approaches to avoid contamination reported. More details in supplemental information.
Metric 2:	Analytical Methodology	Medium	Some analytical methods not reported, such as recovery samples
Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Saudi Arabia (KSA) and Kuwait
Metric 5:	Currency	Medium	Data collected between 2011-12 (Saudi Arabia) and 2014-15 (Kuwait)
Metric 6:	Spatial and Temporal Variability	Medium	Although replicates were not collected, samples were extracted in triplicate.
Metric 7:	Exposure Scenario	High	Indoor dust environments cars, air conditioners, and household floor dust.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	raw data not reported
Metric 9:	Quality Assurance	Medium	Analytical QA/QC was described, but not all reported, missing recoveries.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Uncertainty and variability sources discussed.

Overall Quality Determination   High

Study Citation:	Ipapo, K. N., Factor-Litvak, P., Whyatt, R. M., Calafat, A. M., Diaz, D., Perera, F., Rauh, V., Herbstman, J. B. (2017). Maternal prenatal urinary phthalate metabolite concentrations and visual recognition memory among infants at 27 weeks. Environmental Research 155:7-14.
HERO ID:	3859030

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	participants and sampling described briefly, spot urine samples from mothers
	Metric 2:	Analytical Methodology	Medium	methods previously described (Kato et al., 2005); LOD provided.
	Metric 3:	Biomarker Selection	High	metabolite in urine
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	U.S.
	Metric 5:	Currency	Low	1998-2006
	Metric 6:	Spatial and Temporal Variability	Medium	n = 168, no replicates, urine spot samples
	Metric 7:	Exposure Scenario	High	biomonitoring
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	geometric mean, 95%CI, range, %<LOD, 25%, median, 75%
	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:	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:	Yang, T. C., Peterson, K. E., Meeker, J. D., Sánchez, B. N., Zhang, Z., Cantoral, A., Solano, M., Tellez-Rojo, M. M. (2017). Bisphenol A and phthalates in utero and in childhood: association with child BMI z-score and adiposity. Environmental Research 156:326-333.		
HERO ID:	3859043		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Participant characteristics and urine sampling were described.
Metric 2:	Analytical Methodology	Medium	Method details were mostly described elsewhere (Lewis et al., 2013; Calafat et al., 2008; Silva et al., 2007). The methods were modified based on an unspecified validated CDC method.
Metric 3:	Biomarker Selection	High	MiBP is specific to DiBP.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Study was conducted in Mexico.
Metric 5:	Currency	Medium	Samples were collected in 2012.
Metric 6:	Spatial and Temporal Variability	Low	Authors collected 223 prenatal urine samples and 242 urine samples from children. Only a spot (second morning void) was collected.
Metric 7:	Exposure Scenario	High	This is a biomonitoring study were exposure to children occurred in-utero.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Summary statistics included geometric mean, SD, min, max, 25th, 50th, 75th percentiles. No raw data were provided.
Metric 9:	Quality Assurance	Low	Specific-gravity was accounted for, but QA/QC techniques were mostly not discussed.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Some limitations were reported toward the end of Discussion.

Overall Quality Determination   **Medium**

Study Citation:	Sobolewski, M., Weiss, B., Martin, M., Gurven, M., Barrett, E. (2017). Toxicoanthropology: Phthalate exposure in relation to market access in a remote forager-horticulturalist population. International Journal of Hygiene and Environmental Health 220(5):799-809.		
HERO ID:	3859047		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Participants and sampling described, not much detail about urine sampling timing.
Metric 2:	Analytical Methodology	Medium	Method briefly described with further details cited in Silva et al., 2007. LOD reported in Table 1.
Metric 3:	Biomarker Selection	High	Metabolite in urine.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Bolivia
Metric 5:	Currency	Medium	2008-2009
Metric 6:	Spatial and Temporal Variability	Medium	n = 59, no replicates, limited details about urine sampling timing.
Metric 7:	Exposure Scenario	High	Biomonitoring
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	25th, median, 75th.
Metric 9:	Quality Assurance	Low	QA not discussed, no obvious concerns.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Variability and uncertainty including factors leading to metabolite variation and study limitations discussed.

Overall Quality Determination   Medium

Study Citation:	Sakhi, A. K., Sabaredzovic, A., Cequier, E., Thomsen, C. (2017). Phthalate metabolites in Norwegian mothers and children: Levels, diurnal variation and use of personal care products. Science of the Total Environment 599-600:1984-1992.		
HERO ID:	3859057		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Participants and sampling described. Approaches to avoid contamination reported. Urine samples from mother and child. Morning void urine sample and evening samples. A subset provided daily spot urine samples.
Metric 2:	Analytical Methodology	Medium	Methods described else where (Sabaredzovic et al., 2015) and briefly described in text. LOD provided in S1. Reported using QA/QC, some is shown, nothing about calibration.
Metric 3:	Biomarker Selection	High	metabolite in urine
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Norway
Metric 5:	Currency	Medium	2012
Metric 6:	Spatial and Temporal Variability	Medium	n = 23 to 48 depending on timepoint, no replicates
Metric 7:	Exposure Scenario	High	biomonitoring
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	median, min, max
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:	Šidlovská, M., Petrovičová, I., Kolena, B., Pilka, T., Šovčíková, E., Trnovec, T. (2017). Exposure of children to phthalates and the impact of consumer practices in Slovakia. Reviews on Environmental Health 32(1-2):211-214.		
HERO ID:	3859080		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Participants and sampling described only briefly. Some information such as urine collection equipment and storage duration was missing.
	Metric 2: Analytical Methodology	Low	Authors cited previously reported method by Pilka et al. LODs/LOQs were not provided.
	Metric 3: Biomarker Selection	High	MiBP is specific to DiBP.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Samples were collected in Slovakia.
	Metric 5: Currency	Low	Only a publication year of 2017 was provided.
	Metric 6: Spatial and Temporal Variability	Low	The study consisted of 107 children. No sample replicates were collected, and authors reported only urine spot samples.
	Metric 7: Exposure Scenario	High	This is a biomonitoring where exposure occurs through the widespread use of phthalates.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	No raw data were provided.
	Metric 9: Quality Assurance	Low	Authors did not discuss their QA/QC protocol.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Low	Standard deviation was provided in Table 1. There was no discussion of limitations, gaps, or uncertainties.

Overall Quality Determination   Medium

Study Citation:	González-Mariño, I., Rodil, R., Barrio, I., Cela, R., Quintana, J. B. (2017). Wastewater-based epidemiology as a new tool for estimating population exposure to phthalate plasticizers. Environmental Science & Technology 51(7):3902-3910.		
HERO ID:	3859087		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Key sampling methods reported. Wastewater from various plants, collected by automatic samplers operating in time proportional mode
	Metric 2: Analytical Methodology	High	Key analytical methods reported. Used liquid chromatography-tandem mass spectrometry (LC−MS/MS) for analysis of samples. Limits of quantification reported in text.
	Metric 3: Biomarker Selection	High	Metabolites in wastewater, see table 1 for matching of metabolites to parent chemical.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Spain
	Metric 5: Currency	High	Samples collected in 2015 and 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	High	Raw data reported
	Metric 9: Quality Assurance	High	Analytical QA/QC reported
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Few gaps and limitations reported

Overall Quality Determination   High

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	Medium	Tables 1-3 provide range, mean, median, n, and DF for each media in wet, medium, and dry season. No raw data were available.
	Metric 9:	Quality Assurance	High	The range of recoveries was provided on p. 40 (section 2.4) were acceptable. Authors also reported analyzing sample duplicate, procedural blank, and spiked blank.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variance was characterized with range but only minimal discussion of limitations and uncertainties.

Overall Quality Determination   **High**

Study Citation:	Subedi, B., Sullivan, K. D., Dhungana, B. (2017). Phthalate and non-phthalate plasticizers in indoor dust from childcare facilities, salons, and homes across the USA. Environmental Pollution 230:701-708.		
HERO ID:	3860935		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods, materials, location, time and storage conditions reported.
	Metric 2:	Analytical Methodology	Medium	Analytical methods, instrument and LOD reported as a range.
	Metric 3:	Biomarker Selection	N/A	Concentrations reported in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples taken from South Dakota, Ohio, Indiana, Kentucky, Texas, Maryland, California and Massachusetts.
	Metric 5:	Currency	High	Samples taken in 2016.
	Metric 6:	Spatial and Temporal Variability	Medium	12 childcare facility samples, 5 salon samples, 11 home samples taken. No replicates were taken.
	Metric 7:	Exposure Scenario	High	The study represents indoor air exposure for the general population.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual points reported. Summary stats not reported.
	Metric 9:	Quality Assurance	High	QA/QC reported in detail. Recoveries over 100% reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	No gaps nor limitations reported. Variability accounted for in different settings sampled.

Overall Quality Determination   High

Study Citation:	Messerlian, C., Bellinger, D., Mínguez-Alarcón, L., Romano, M. E., Ford, J. B., Williams, P. L., Calafat, A. M., Hauser, R., Braun, J. M. (2017). Paternal and maternal preconception urinary phthalate metabolite concentrations and child behavior. Environmental Research 158:720-728.		
HERO ID:	3972244		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Pertinent sampling methods (e.g., participants characteristics, sampling periods, equipment, and storage) were described.
	Metric 2:	Analytical Methodology	Medium	Analytical method identified as solid phase extraction-high performance liquid chromatography-isotope dilution tandem mass spectrometry with a reference to Silva et al., 2007. No further details were provided. LOD provided in SI.
	Metric 3:	Biomarker Selection	High	MiBP is specific to DiBP.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Participants were from the US.
	Metric 5:	Currency	Low	It is unclear when urine samples were taken from mothers and fathers, but could have started as early as 2004 and lasted through 2015. Scoring low because of the uncertainty and wide time period for sample collection.
	Metric 6:	Spatial and Temporal Variability	Low	More than 100 samples were collected at different points in preconception among women and men. There was no report of replicates. Multiple spot urine samples were collected, and it is unclear if they were pooled or not (likely not).
	Metric 7:	Exposure Scenario	High	This is a biomonitoring study.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1A of SI provides detection frequency, GM, GSD, median, and IQR. Raw data were not provided.
	Metric 9:	Quality Assurance	Medium	Urine dilution was accounted with specific gravity. However, little else QA/QC methods were described.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variance characterized with geometric standard deviation and IQR. Limitations described in Discussion.

Overall Quality Determination   **Medium**

		Domain	Metric	Rating	Comments

Study Citation: Huang, Y. F., Pan, W. C., Tsai, Y. A., Chang, C. H., Chen, P. J., Shao, Y. S., Tsai, M. S., Hou, J. W., Lu, C. A., Chen, M. L. (2017). Concurrent exposures to nonylphenol, bisphenol A, phthalates, and organophosphate pesticides on birth outcomes: A cohort study in Taipei, Taiwan. Science of the Total Environment 607-608:1126-1135.

HERO ID: 3972262

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods (e.g., participant characteristics, equipment, storage) were reported.
	Metric 2:	Analytical Methodology	Medium	Extraction and analytical methods were reported, as well as LODs and recoveries. However, analytical methods were brief as only a reference was provided.
	Metric 3:	Biomarker Selection	High	MiBP is specific to DiBP.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Participants were in Taiwan.
	Metric 5:	Currency	Medium	Samples collected in 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	162 women provided three spot urine samples with no replicates, but only 112 of them were analyzed for phthalates due to small sample volume. Urine samples were pooled.
	Metric 7:	Exposure Scenario	High	This is a biomonitoring study where widespread exposure occurs through use of a variety of products, etc
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	High	QA/QC methods were reported (e.g., blank and spiked samples, recoveries which were acceptable, creatinine analysis).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some gaps and limitations were reported at the end of Discussion. Variance characterized with range.

Overall Quality Determination   **High**

Study Citation:	Watkins, D. J., Sánchez, B. N., Téllez-Rojo, M. M., Lee, J. M., Mercado-García, A., Blank-Goldenberg, C., Peterson, K. E., Meeker, J. D. (2017). Impact of phthalate and BPA exposure during in utero windows of susceptibility on reproductive hormones and sexual maturation in peripubertal males. Environmental Health 16(1):69.		
HERO ID:	3972348		

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	participant information and sampling summary provided. Measures to avoid sampling phthalate contamination missing
	Metric 2:	Analytical Methodology	Medium	LOD provided; analysis conducted at NSF International. Missing QA/QC.
	Metric 3:	Biomarker Selection	High	metabolite in urine
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Mexico
	Metric 5:	Currency	Low	1997 to 2004
	Metric 6:	Spatial and Temporal Variability	Medium	n = 199 to 229 depending on visit, no replicates, urine morning void
	Metric 7:	Exposure Scenario	High	Biomonitoring
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	GM, GSD, max 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:	Gaspéri, J., Ayrault, S., Moreau-Guigon, E., Alliot, F., Labadie, P., Budzinski, H., Blanchard, M., Muresan, B., Caupos, E., Cladière, M., Gateuille, D., Tassin, B., Bordier, L., Teil, M. J., Bourges, C., Desportes, A., Chevreuil, M., Moilleron, R. (2016). Contamination of soils by metals and organic micropollutants: case study of the Parisian conurbation. Environmental Science and Pollution Research 25(24):23559-23573.		
HERO ID:	3985396		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	32 soil samples (fig 1) using a auger to collect first 10cm; each sample pooled three different cores collected 5 m from one another; homogenized and bagged; stored in dark; freeze-dried, ground, and stored at 4C
Metric 2:	Analytical Methodology	Medium	extraction method not discussed; GC-MS; LOQ provided in Table S2; recovery samples not discussed
Metric 3:	Biomarker Selection	N/A	soil samples
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Greater Paris, France
Metric 5:	Currency	Medium	2009-2010
Metric 6:	Spatial and Temporal Variability	Medium	32 samples (rural = 12; urban=20) sampled over a year; no replicates
Metric 7:	Exposure Scenario	High	levels in soil from rural and densely urbanized areas
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Low	briefly discussed in text (range) p.23565 also depicted in Fig 4 (mean and SD); no indication results in SI
Metric 9:	Quality Assurance	Low	states "analyzed according to validated methods"
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	compares results to previous studies and around the world

Overall Quality Determination   Medium

Study Citation:	Celeiro, M., Dagnac, T., Llompart, M. (2017). Determination of priority and other hazardous substances in football fields of synthetic turf by gas chromatography-mass spectrometry: A health and environmental concern. Chemosphere 195:201-211.		
HERO ID:	4166969		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Detailed and clear sampling methodology
	Metric 2:	Analytical Methodology	Medium	Limited details about recoveries, reported LOD
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Spain
	Metric 5:	Currency	Medium	published in 2018, but sites were built after 2009 and replenished in the sampled materials periodically.
	Metric 6:	Spatial and Temporal Variability	Medium	15 samples, no replicates
	Metric 7:	Exposure Scenario	High	Data are likely to represent a relevant exposure scenario
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	individual sample concentrations and summary statistics reported
	Metric 9:	Quality Assurance	Medium	Limited information on recoveries, field and laboratory controls were analyzed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Key uncertainties and limitations are not discussed

Overall Quality Determination   Medium

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

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

Overall Quality Determination   Medium

Study Citation:	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:	Wang, L., Gong, M., Xu, Y., Zhang, Y. (2017). Phthalates in dust collected from various indoor environments in Beijing, China and resulting non-dietary human exposure. Building and Environment 124(Elsevier):315-322.		
HERO ID:	4176702		

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	Low	The analytical methodology is described; however, the limit of detection is mentioned but the value of the limit is not provided.
	Metric 3: Biomarker Selection	N/A	Study is testing for parent chemical in house dust.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Samples were collected in Beijing.
	Metric 5: Currency	Medium	Samples were collected from 2010 to 2011.
	Metric 6: Spatial and Temporal Variability	Medium	No replicate samples collected
	Metric 7: Exposure Scenario	High	Exposure scenario is concentration in dust in houses, which is a scenario of interest.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Raw data is not provided, but summary statistics are 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	Variability and uncertainty are characterized and discussed. Ranges are given for measurements.

Overall Quality Determination   High

Study Citation: Olesen, T. S., Bleses, D., Andersen, H. R., Grandjean, P., Frederiksen, H., Trecca, F., Bilenberg, N., Kyhl, H. B., Dalsager, L., Jensen, I. K., Andersson, A. M., Jensen, T. K. (2017). Prenatal phthalate exposure and language development in toddlers from the Odense Child Cohort. Neurotoxicology and Teratology 65:34-41.

HERO ID: 4198566

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Most pertinent sampling information is provided in the data source or companion source, including sample storage condition and population characteristics, but lacking sampling equipment and specific sampling procedures/regime, performance/calibration of sampler.
	Metric 2:	Analytical Methodology	High	Analytical techniques were reported (LC-MS/MS) and LOD were reported for each metabolite (see supplemental table S1).
	Metric 3:	Biomarker Selection	High	Biomarker (parent chemical or metabolite) is derived from exposure to the chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Odense, Denmark
	Metric 5:	Currency	Medium	2010-2012
	Metric 6:	Spatial and Temporal Variability	High	Urinary samples from 518 pregnant women were reported.
	Metric 7:	Exposure Scenario	Medium	The data likely represent the relevant exposure scenario of children. Study does not have detailed information on source of exposure.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics reported. Raw data not given.
	Metric 9:	Quality Assurance	Medium	The study applied and documented quality assurance/quality control measures and described the completeness of samples including measuring osmolality; however, one piece of QA/QC information, recoveries, is not described. Missing information is unlikely to have a substantial impact on results.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Key uncertainties, limitations, and data gaps have been identified. Study also compared with other studies (see supplemental).

Overall Quality Determination   High

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

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

Overall Quality Determination   Medium

| Study Citation: | Liang, J., Ning, X. A., Kong, M., Liu, D., Wang, G., Cai, H., Sun, J., Zhang, Y., Lu, X., Yuan, Y. (2017). Elimination and ecotoxicity evaluation of phthalic acid esters from textile-dyeing wastewater. Environmental Pollution 231(Pt 1):115-122. |
| HERO ID: | 4259743 |

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Methods, location, equipment and storage condition reported.
	Metric 2:	Analytical Methodology	Medium	Key analytical methods and instrument reported. Limit of detection reported as a range.
	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 was conducted in China.
	Metric 5:	Currency	High	Sampling campaign conducted in 2017.
	Metric 6:	Spatial and Temporal Variability	Low	4 plants sampled with no replicates.
	Metric 7:	Exposure Scenario	Medium	The samples are taken from wastewater effluent which is an applicable exposure scenario.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics reported. Raw data not reported.
	Metric 9:	Quality Assurance	High	QA procedures followed and all recoveries >70%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	No gaps and limitations reported. Variability accounted for different plants sampled.

Overall Quality Determination   Medium

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	High	MiBP in first morning urine.
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 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	Medium	Reported n, % detect, mean (and SD), geometric mean, 5th, 25th, 50th, 75th, and 95th percentiles (not raw data).
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	Medium	Children sampled across all 4 seasons; however, only one first morning urine sample per child. Study limitations noted; compared results with those from 9 other countries (Figure 1).

Overall Quality Determination   High

Study Citation:	He, M. J., Lu, J. F., Ma, J. Y., Wang, H., Du, X. F. (2018). Organophosphate esters and phthalate esters in human hair from rural and urban areas, Chongqing, China: Concentrations, composition profiles and sources in comparison to street dust. Environmental Pollution 237(Elsevier):143-153.		
HERO ID:	4574307		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Sampling methodology was detailed in terms of equipment, procedures, sample storage conditions, study site characteristics for hair and dust. Insufficient information was provided on sample storage duration prior to analysis.
Metric 2:	Analytical Methodology	High	Analytical methodology was described in terms of extraction and recovery range and referenced in terms of analytical instrumentation details within previous study and SI. LOD/LOQ information was presented within SI.
Metric 3:	Biomarker Selection	N/A	The analyte measured is the TSCA chemical.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Samples were collected in Chongqing, China.
Metric 5:	Currency	Medium	Sampling was conducted in 2014 for hair and dust.
Metric 6:	Spatial and Temporal Variability	Medium	There was a large sample size for rural (n=154) and urban (n=43) hair samples, but single sampling for each participant and non-statistical sampling methods. There was a moderate sample size for rural (n=6) and urban (n=6) dust samples and authors note replicate (three sub-samples) sampling, but location of dust sampling within the residence was not described within text and non-statistical sampling methodology.
Metric 7:	Exposure Scenario	High	Participant occupations noted as including government officers, salesmen, students and retired people in urban areas, with agricultural work as the primary occupation of rural participants.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Summary statistics reported in terms of range, mean (SD), median, number of samples, urban/rural location and detection frequencies. Insufficient information was provided on raw data for individual participants.
Metric 9:	Quality Assurance	High	Study QA/QC details within text included laboratory control/blanks, recoveries, and blank-correction of lab results with further information within SI.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Range of chemical-specific concentrations was reported, and results were compared with previous work. Potential sources of exposure for sampling media, and limitations in terms of the exogenous and endogenous source exposures for hair analysis due to unwashed hair sampling and limited sample size for dust sampling was discussed. Authors acknowledge lack of gender analysis due to limited number of female participants, but do not discuss this in relation to concentrations related to personal care products in this study, or other potential study limitations (e.g., possible data gaps).

Overall Quality Determination   High

Study Citation:	Okeme, J. O., Yang, C., Abdollahi, A., Dhal, S., Harris, S. A., Jantunen, L. M., Tsirlin, D., Diamond, M. L. (2018). Passive air sampling of flame retardants and plasticizers in Canadian homes using PDMS, XAD-coated PDMS and PUF samplers. Environmental Pollution 239:109-117.		
HERO ID:	4659643		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The study reports home air sampling and sample storage.
	Metric 2:	Analytical Methodology	Low	The analytical procedures were outlined. Section 2.5 discusses how LOD and LOQ are calculated but no values provided.
	Metric 3:	Biomarker Selection	N/A	The parent chemical was measured in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in greater Toronto area and Ottawa, Canada.
	Metric 5:	Currency	High	Samples were collected in February and August 2015.
	Metric 6:	Spatial and Temporal Variability	High	Samples were collected in 32 homes in the Toronto area and 19 in Ottawa (homes included apartments, detached homes, semi-detached homes, townhouses, and condos); sampled for 3 weeks; duplicate and field blanks were collected.
	Metric 7:	Exposure Scenario	Medium	The study focused on home sampling; 5 apartments, 34 detached homes, 7 semi-detached; 3 townhouses and 2 condos; number of residents ranged from 1 to 7
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data is not reported. Section 3.3 reported concentrations (min, max, median, mean, SD) and DF provided in Table S3d.
	Metric 9:	Quality Assurance	Medium	QA/QC reported in Section 2.5; recovery was corrected for individual compounds.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limitations are not reported, variability reported as SD, and comparison between other studies.

Overall Quality Determination   Medium

| | | Study Citation: | Minatoya, M., Araki, A., Miyashita, C., Ait Bamai, Y., Itoh, S., Yamamoto, J., Onoda, Y., Ogasawara, K., Matsumura, T., Kishi, R. (2018). Association between prenatal bisphenol A and phthalate exposures and fetal metabolic related biomarkers: The Hokkaido study on Environment and Children's Health. Environmental Research 161:505-511. |
| | | HERO ID: | 4728391 |

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods, participant information and sample storage all reported.
	Metric 2:	Analytical Methodology	High	Analytical methods, instrument, calibration 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 was conducted in Japan.
	Metric 5:	Currency	Low	Sampling from 2003-2012.
	Metric 6:	Spatial and Temporal Variability	Low	365 samples with no replicates.
	Metric 7:	Exposure Scenario	High	Data represents exposure scenarios of pregnant women.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics reported. No raw data reported.
	Metric 9:	Quality Assurance	High	QA/QC techniques discussed in supplemental, including recoveries >70%. Limitations also reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Characterized variability and discussed uncertainties and limitations

Overall Quality Determination   **High**

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

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

Overall Quality Determination   **Medium**

Study Citation:	Li, X., Sun, H., Yao, Y., Zhao, Z., Qin, X., Duan, Y., Wang, L. (2018). Distribution of phthalate metabolites between paired maternal-fetal samples. Environmental Science & Technology 52(11):6626-6635.		
HERO ID:	4728430		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Low	Participants described. Sample collection not described.
Metric 2:	Analytical Methodology	Medium	Sample preparation described in SI. Mass spec described. Method detection limit in SI
Metric 3:	Biomarker Selection	High	metabolite in urine
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	China
Metric 5:	Currency	High	2015
Metric 6:	Spatial and Temporal Variability	Medium	n = 80 to 83 depending on sample type, no replicates, no details about urine sample collection
Metric 7:	Exposure Scenario	High	biomonitoring
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	detection rate, mean, median, GM, and range provided. No raw data.
Metric 9:	Quality Assurance	High	Blanks, spikes, and calibration described.
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: Machtinger, R., Zhong, J., Mansur, A., Adir, M., Racowsky, C., Hauser, R., Brennan, K., Karlsson, O., Baccarelli, A. A. (2018). Placental lncRNA Expression Is Associated With Prenatal Phthalate Exposure. Toxicological Sciences 163(1):116-122.

HERO ID: 4728442

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Participants and sampling described.
	Metric 2:	Analytical Methodology	Medium	LOD provided, CDC performed analyses.
	Metric 3:	Biomarker Selection	High	Metabolite in urine.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Israel
	Metric 5:	Currency	High	2015
	Metric 6:	Spatial and Temporal Variability	Low	n = 10, no replicates, urine samples not pooled.
	Metric 7:	Exposure Scenario	High	Biomonitoring
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	% below LOD, mean, median, max provided.
	Metric 9:	Quality Assurance	Medium	Standard quality assurance/quality control procedures discussed in detail before (Silva et al., 2013, 2017).
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: | Machtinger, R., Berman, T., Adir, M., Mansur, A., Baccarelli, A. A., Racowsky, C., Calafat, A. M., Hauser, R., Nahum, R. (2018). Urinary concentrations of phthalate metabolites, bisphenols and personal care product chemical biomarkers in pregnant women in Israel. Environment International 116(Elsevier):319-325. |
| HERO ID: | 4728447 |

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods reported.
	Metric 2:	Analytical Methodology	Medium	Some analytical methods not reported such as recovery samples.
	Metric 3:	Biomarker Selection	High	Acceptable biomarker.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Israel
	Metric 5:	Currency	High	Samples collected in 2015 and 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	QC referenced.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some limitations reported.

Overall Quality Determination   High

Study Citation:	Kishi, R., Ketema, R. M., Bamai, Y. A., Araki, A., Kawai, T., Tsuboi, T., Saito, I., Yoshioka, E., Saito, T. (2018). Indoor environmental pollutants and their association with sick house syndrome among adults and children in elementary school. Building and Environment 136:293-301.		
HERO ID:	4728476		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	The sampling methodology is discussed, scientifically sound and consistent with widely accepted methods/approaches for the chemical and media being analyzed. The references for the full sampling description are provided.
Metric 2:	Analytical Methodology	High	Analytical methodology is described, including analytical instrumentation and scientifically appropriate for the chemical and media analyzed. LOD is reported. The previous studies are referred for analysis method.
Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	The study was conducted in Sapporo, Japan.
Metric 5:	Currency	Medium	The samples were collected in October and November of 2009 and 2010.
Metric 6:	Spatial and Temporal Variability	High	There were 128 samples and no replicates.
Metric 7:	Exposure Scenario	High	Indoor air exposures were measured in the residential house.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Full Raw data are not reported. Summary statistics were reported.
Metric 9:	Quality Assurance	High	Quality assurance procedures in sample collection and analysis were reported with most key criteria met.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Limitations are well described but variability and uncertainty are not well discussed.

Overall Quality Determination   High

Study Citation:	Kim, S., Eom, S., Kim, H. J., Lee, J. J., Choi, G., Choi, S., Kim, S., Kim, S. Y., Cho, G., Kim, Y. D., Suh, E., Kim, S. K., Kim, S., Kim, G. H., Moon, H. B., Park, J., Kim, S., Choi, K., Eun, S. H. (2018). Association between maternal exposure to major phthalates, heavy metals, and persistent organic pollutants, and the neurodevelopmental performances of their children at 1 to 2 years of age{\textendash}CHECK cohort study. Science of the Total Environment 624:377-384.		
HERO ID:	4728479		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Low	The description of sampling methodology is limited. Authors cite previously peer-reviewed publications for more details.
Metric 2:	Analytical Methodology	Low	Analytical methodology not described. Authors cite previously peer-reviewed publications for more details. Detection limits provided in footnote of Table 2 and matrix-adjustment creatinine adjustment reported.
Metric 3:	Biomarker Selection	High	Sampling for metabolites in urine and breast milk specific for parent chemical of interest.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Samples provided by participants recruited from Seoul, Anyang, Ansan, and Jeju, Republic of Korea.
Metric 5:	Currency	Low	Sample collection dates not reported, but study publication date is 2018.
Metric 6:	Spatial and Temporal Variability	Medium	There were 86 maternal urine samples and 73 breast milk samples. Replicate samples not indicated.
Metric 7:	Exposure Scenario	Medium	Biomonitoring study where pregnant women-fetus pairs recruited from cities.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Raw data not reported. Several summary statistics provided, including median, interquartile range, and frequency of detection.
Metric 9:	Quality Assurance	Low	QA/QC not discussed. Authors cite previously peer-reviewed publications for more details on methodology.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Limitation of study is discussed. Paper also discusses findings from other like studies.

Overall Quality Determination   Medium

Study Citation:	Huffman, A. M., Wu, H., Rosati, A., Rahil, T., Sites, C. K., Whitcomb, B. W., Richard Pilsner, J. (2018). Associations of urinary phthalate metabolites and lipid peroxidation with sperm mitochondrial DNA copy number and deletions. Environmental Research 163:10-15.		
HERO ID:	4728509		

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

Overall Quality Determination   Medium

Study Citation: Liao, K. W., Kuo, P. L., Huang, H. B., Chang, J. W., Chiang, H. C., Huang, P. C. (2018). Increased risk of phthalates exposure for recurrent pregnancy loss in reproductive-aged women. Environmental Pollution 241:969-977.

HERO ID: 4728516

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Participant information, sampling methods and storage conditions reported.
Metric 2:	Analytical Methodology	Medium	LOD provided in text. method described previously (Huang et al.,2015; Huang et al., 2016).
Metric 3:	Biomarker Selection	High	Metabolite is known to be from parent in urine.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Study was conducted in Taiwan.
Metric 5:	Currency	High	Study was conducted between 2013 and 2017.
Metric 6:	Spatial and Temporal Variability	Medium	n = 76 (control group), n = 103 (recurrent pregnancy loss group), no replicates, urine sample details not provided.
Metric 7:	Exposure Scenario	High	The study is measuring phthalates in pregnant women urine.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	The study reports detection rate %, median and range. Raw data not reported.
Metric 9:	Quality Assurance	Medium	Blanks, spikes, repeated samples, and recovery included. However, the exact recovery percent is not reported.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	Variability account for different ages sampled. Limitations discussed.

Overall Quality Determination   High

Study Citation:			Hartle, J. C., Cohen, R. S., Sakamoto, P., Barr, D. B., Carmichael, S. L. (2018). Chemical contaminants in raw and pasteurized human milk. Journal of Human Lactation 34(2):340-349.
HERO ID:			4728555

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Included only milk from women who passed screen for risk factors, medications, and serology. Milk collected in BPA-free bags and stored at CA state milk bank at -20 C. Method of milk collection by women not specified.
	Metric 2:	Analytical Methodology	High	Samples deglucuronidized; analyzed by isotope dilution, SPE, HPLC- negative ion electrospray-MS/MS; LODs in SI. Lipid content measured. Reviewed analytic details provided in previous publication (Calafat et al. 2004, HERO 673259). The study reported the LOD in the SI
	Metric 3:	Biomarker Selection	High	Analyzed breast milk, pre- and post-pasteurization, for MIBP.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were from across California
	Metric 5:	Currency	High	Samples were collected in 2015.
	Metric 6:	Spatial and Temporal Variability	High	Analyzed milk donated by 21 women from across California to CA milk bank (sample bags selected randomly from storage). Some categories of ethnicity, parity, age, CA region, and baby's age were represented by few individuals.
	Metric 7:	Exposure Scenario	Medium	The study evaluated the presence and co-occurrence of contaminants in human milk and the effects of pasteurization.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data provided in Excel in SI, along with LOD and summary statistics (mean, SD, percentiles, range).
	Metric 9:	Quality Assurance	High	Used blanks, duplicate samples, and spiked QC materials (approximately 15% of samples tested); accuracy 93%-102%; RSD 7%-13%. Previous method validation was reported in HERO 673259.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Discussed possible reasons for increased phthalate concentrations after pasteurization; recognized limitations for "self-selected" nature of women donating milk and relatively small sample size.

Overall Quality Determination   High

Study Citation:	Watkins, D. J., Sánchez, B. N., Téllez-Rojo, M. M., Lee, J. M., Mercado-García, A., Blank-Goldenberg, C., Peterson, K. E., Meeker, J. D. (2017). Phthalate and bisphenol A exposure during in utero windows of susceptibility in relation to reproductive hormones and pubertal development in girls. Environmental Research 159:143-151.		
HERO ID:	4728621		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Well described sampling methods.
Metric 2:	Analytical Methodology	High	Detailed analytical methods, reported LOD.
Metric 3:	Biomarker Selection	High	Biomarker is known to be related to external exposure.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Mexico
Metric 5:	Currency	Low	Sampling began in 1997.
Metric 6:	Spatial and Temporal Variability	Low	n=97, with 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	Medium	Limited description about QA/QC techniques.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Characterized variability, discussed uncertainties and limitations.

Overall Quality Determination   High

Study Citation:	Duan, Y., Wang, L., Han, L., Wang, B., Sun, H., Chen, L., Zhu, L., Luo, Y. (2017). Exposure to phthalates in patients with diabetes and its association with oxidative stress, adiponectin, and inflammatory cytokines. Environment International 109(Elsevier):53-63.		
HERO ID:	4728629		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Low	Sampling equipment and methods are only briefly discussed, therefore certain aspects (e.g. material components of sampling vessel) are absent that may have a substantial impact on results.
Metric 2:	Analytical Methodology	High	Analytical instrumentation and methods are reported in sufficient detail, are referenced to other published studies, and are scientifically sound. LOD and LOQ are reported.
Metric 3:	Biomarker Selection	Low	The monoester phthalate biomarker is a metabolite of just the chemical of interest.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Tianjin, China
Metric 5:	Currency	High	May-July 2016
Metric 6:	Spatial and Temporal Variability	Low	Unpooled spot urine samples from 343 participants collected between 9:00 and 11:00 a.m.
Metric 7:	Exposure Scenario	Medium	Exposure scenarios for sampled population not well characterized.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Raw data are not reported; summary statistics include geometric mean, median, minimum, and maximum concentrations, as well as medians by various population stratifications.
Metric 9:	Quality Assurance	High	QA/QC methods included the use of procedural blanks, spiked samples, and surrogate standards to determine background contamination, spiked matrix recovery, and relative standard deviation. All values were within acceptable ranges or adjustments were made to correct (in the case of background contamination).
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Characterization of variability is reported, and variability across certain population stratifications is analyzed. Methodological limitations and sources of uncertainty are briefly discussed, including the limit of study population only being diabetic patients and only using one spot sample per participant.

Overall Quality Determination   Medium

Study Citation: Dales, R. E., Kauri, L. M., Cakmak, S. (2018). The associations between phthalate exposure and insulin resistance, ${\ensuremath{\beta}}$-cell function and blood glucose control in a population-based sample. Science of the Total Environment 612:1287-1292.

HERO ID: 4728651

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sample methodology was not the most comprehensive. It explained a nationally representative population from Canadian Health Measures Survey (CHMS), Cycle 2, their enrollment criteria, and one "midstream" urine sample collected per person (blood collected same day).
	Metric 2:	Analytical Methodology	Low	SPE UPLC-MS-MS analyses conducted by Centre de Toxicologie du Quebec as described in Saravanabhavan et al. (2013), which refers back to another study. Only the analytical method (UPLC-MS-MS) and LODs were provided.
	Metric 3:	Biomarker Selection	High	MiBP is specific to DiBP.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Participants were from Canada.
	Metric 5:	Currency	Medium	Participants were recruited during 2009-2011.
	Metric 6:	Spatial and Temporal Variability	Low	Sampling is representative of 96% of Canada. It included 2,119 individuals between 12 and 29 years of age from 18 sites across 5 regions. Only spot samples (i.e., single mid-stream) were collected per person.
	Metric 7:	Exposure Scenario	Medium	Questionnaire covered lifestyle factors including alcohol consumption, cigarette smoking, and physical activity. Questions related to possible sources of phthalate exposure were not included, but this is a biomonitoring study where exposure sources are difficult to pinpoint.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Data reported geometric mean, GM standard error, and interquartile range across entire sample population. Creatinine was adjusted for. No raw data were provided.
	Metric 9:	Quality Assurance	Low	QA/QC methods mostly missing. Authors referred to previous publications - HERO 1597648 and 1325357 - that may explain QA/QC protocols.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	There is some discussion of limitations in Discussion.

Overall Quality Determination   Medium

Study Citation:	Bu, Z., Wang, J., Yu, W.,ei, Li, B. (2018). Dermal exposure to phthalates in home environment: Handwipes, influencing factors and implications. Building and Environment 133:1-7.		
HERO ID:	4728663		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Sampling by wipes described. Four swipes in the same part of the hand with the same wipe to achieve max removal. Sampled air and dust as well. Process was mentioned and described elsewhere.
Metric 2:	Analytical Methodology	Medium	Analytical method described, MDL estimate approach provided, but MDL values were not reported.
Metric 3:	Biomarker Selection	N/A	Not a biomonitoring study.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Southwestern China, Chongqing
Metric 5:	Currency	Medium	Data collected 2014 to 2015
Metric 6:	Spatial and Temporal Variability	Medium	No replicate samples collected
Metric 7:	Exposure Scenario	High	Dermal, but not product or activity specific.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	No raw data reported
Metric 9:	Quality Assurance	Medium	QA/QC not directly mentioned in the study - this study referenced a different study
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Statistical uncertainties discussed in Section 3.5 Limitations.

Overall Quality Determination   High

Study Citation:	Buckley, J. P., Quirós-Alcalá, L., Teitelbaum, S. L., Calafat, A. M., Wolff, M. S., Engel, S. M. (2018). Associations of prenatal environmental phenol and phthalate biomarkers with respiratory and allergic diseases among children aged 6 and 7years. Environment International 115:79-88.		
HERO ID:	4728666		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Methodology (e.g., participant characteristics, collection methods, and storage conditions) was adequately described.
Metric 2:	Analytical Methodology	High	LODs given in Table 2. Analytical methods described as solid phase extraction coupled with HPLC-isotope dilution tandem spectrometry. CDC performed the analysis, and references were also provided.
Metric 3:	Biomarker Selection	High	MiBP is specific to DiBP.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Samples were collected in New York.
Metric 5:	Currency	Low	Samples were collected from 1998 to2002.
Metric 6:	Spatial and Temporal Variability	Medium	No replicates were reported. Over 100 samples were analyzed.
Metric 7:	Exposure Scenario	High	This is a biomonitoring study.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Summary statistics only and no raw data were provided.
Metric 9:	Quality Assurance	Medium	Samples were adjusted for creatinine. However, no other QA/QC methods were reported but can be inferred through use of CDC laboratory for testing.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Table 2 characterizes variance. Uncertainties and limitations were discussed.

Overall Quality Determination   High

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:	Bedrosian, L. D., Ferguson, K. K., Cantonwine, D. E., Mcelrath, T. F., Meeker, J. D. (2018). Urinary phthalate metabolite concentrations in relation to levels of circulating matrix metalloproteinases in pregnant women. Science of the Total Environment 613-614:1349-1352.
HERO ID:	4728685

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology is only briefly discussed but study participants are described in another study. Storage conditions are reported. However, equipment to collect the samples are not reported.
	Metric 2:	Analytical Methodology	Low	Analytical methodology is reported to have followed a modified version of LC-MS/MS method developed by the CDC and is referenced to another study. However, detection limits are not reported.
	Metric 3:	Biomarker Selection	Low	The monoester phthalate biomarker 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 just the chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Boston, United States.
	Metric 5:	Currency	Medium	Samples were collected 2006-2008.
	Metric 6:	Spatial and Temporal Variability	Low	Unpooled spot urine samples from 134 participants at one timepoint.
	Metric 7:	Exposure Scenario	High	The study is measuring phthalate concentrations in pregnant women.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data are not reported; summary statistics include geometric mean, maximum, and percentiles (25, 50, 75, 95) of biomarker 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	High	Characterization of variability is reported, and limitations of the study are discussed (i.e., acknowledgement of the limited statistical power of the exploratory study with small sample size).

Overall Quality Determination   Medium

Study Citation:	Soomro, M. H., Baiz, N., Philippat, C., Vernet, C., Siroux, V., Nichole Maesano, C., Sanyal, S., Slama, R., Bornehag, C. G., Annesi-Maesano, I. (2018). Prenatal exposure to phthalates and the development of eczema phenotypes in male children: results from the EDEN mother-child cohort study. Environmental Health Perspectives 126(2):027002.		
HERO ID:	4728712		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Concise but scientifically sound methods.
Metric 2:	Analytical Methodology	Medium	Limited description, reported LOD.
Metric 3:	Biomarker Selection	High	Biomarker known to be related to external exposure.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	France
Metric 5:	Currency	High	Published in 2018.
Metric 6:	Spatial and Temporal Variability	Low	n=604, no replicates.
Metric 7:	Exposure Scenario	Medium	Data likely represent relevant exposure scenarios, missing details about the source and exposure characteristics.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Only summary statistics.
Metric 9:	Quality Assurance	Low	QA/QC techniques were not discussed.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Characterized variability, discussed uncertainties and limitations.

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

Domain		Metric	Rating	Comments
Study Citation:		Weiss, J. M., Gustafsson, Å., Gerde, P., Bergman, Å., Lindh, C. H., Krais, A. M. (2018). Daily intake of phthalates, MEHP, and DINCH by ingestion and inhalation. Chemosphere 208:40-49.		
HERO ID:		4728899		
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methods not reported, such as sample storage conditions. Pooled school dust sampling was not explained to people collecting samples and hence potential differences in collection.
	Metric 2:	Analytical Methodology	Medium	Some analytical methods not reported, such as recovery samples.
	Metric 3:	Biomarker Selection	N/A	Not biomonitoring samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Sweden
	Metric 5:	Currency	Medium	Not reported. FORMAS project is dated to 2012, but sampling could have occurred at various times. Sampling time can range from 2012 to 2018.
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates.
	Metric 7:	Exposure Scenario	Medium	Household dust collected from children's sleeping roomsand from living rooms and in schools at three locations inSweden.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not provided.
	Metric 9:	Quality Assurance	Medium	LOD reported, recovery samples not reported. Blanks and other QC samples were used to discuss results.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported.

Overall Quality Determination   Medium

Study Citation:	Wenzel, A. G., Bloom, M. S., Butts, C. D., Wineland, R. J., Brock, J. W., Cruze, L., Unal, E. R., Kucklick, J. R., Somerville, S. E., Newman, R. B. (2018). Influence of race on prenatal phthalate exposure and anogenital measurements among boys and girls. Environment International 110:61-70.		
HERO ID:	4728953		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Medium. Most key criteria met, lack of duration of sample storage prior to analysis.
	Metric 2: Analytical Methodology	Medium	Medium. Most key criteria met, LOD's reported, specific gravity considerations for matrix adjustment, lack of recovery data.
	Metric 3: Biomarker Selection	High	High. Metabolites specific for parent chemicals.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	High. Samples collected from participants in Charleston, SC.
	Metric 5: Currency	Medium	Medium. Samples collected from pregnant women recruited 2011-2014.
	Metric 6: Spatial and Temporal Variability	Medium	Medium. Single spot urine specimens collected from main study, subsample gave a second sample, total participating = 380 women, non-statistical sampling method.
	Metric 7: Exposure Scenario	Medium	Medium. Participant characteristics reported in Table 1, some discussion of potential exposure sources, lack of 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. Standard QC methods reported, most key criteria met, recoveries reported, lack of pre-exposure samples.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Medium. Variability described in terms of statistical summary measures, limitations of sampling during gestational weeks (GW) 18-20 rather than earlier, etiologically relevant GW 7-13 noted.

Overall Quality Determination   Medium

Study Citation:	Baurès, E., Blanchard, O., Mercier, F., Surget, E., le Cann, P., Rivier, A., Gangneux, J. P., Florentin, A. (2018). Indoor air quality in two French hospitals: Measurement of chemical and microbiological contaminants. Science of the Total Environment 642:168-179.		
HERO ID:	4729972		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	The air sampling methodology was described in detail.
	Metric 2: Analytical Methodology	Medium	The analytical methods were described and included LOD/LOQ but not recoveries.
	Metric 3: Biomarker Selection	N/A	The authors analyzed air samples.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	The study was conducted in France.
	Metric 5: Currency	Medium	The samples were collected between June 2014 and February 2015
	Metric 6: Spatial and Temporal Variability	High	n>10 air samples, with replicates.
	Metric 7: Exposure Scenario	High	The data closely represent relevant exposure scenarios related indoor airborne pollutants in French Hospitals.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	The authors reported summary statistics and raw data.
	Metric 9: Quality Assurance	High	The authors described QA/QC techniques in detail.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Variability was characterized (SD, range). Little information was reported on limitations and gaps.

Overall Quality Determination   High

Study Citation:	Ait Bamai, Y., Araki, A., Nomura, T., Kawai, T., Tsuboi, T., Kobayashi, S., Miyashita, C., Takeda, M., Shimizu, H., Kishi, R. (2018). Association of filaggrin gene mutations and childhood eczema and wheeze with phthalates and phosphorus flame retardants in house dust: The Hokkaido study on Environment and Children's Health. Environment International 121(Pt 1):102-110.		
HERO ID:	4829235		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	The authors report the microenvironment of the dust collection (living room floor), and the sampling equipment. They also reported the storage conditions but not the storage duration.
Metric 2:	Analytical Methodology	Medium	The authors referred to another paper regarding the methods, but they reported the analytical method used and instrumentation. The authors reported LOQ.
Metric 3:	Biomarker Selection	N/A	NA - Dust sample no biomarker needed.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Samples were collected in Hokkaido Japan.
Metric 5:	Currency	Medium	Samples were collected in 2013.
Metric 6:	Spatial and Temporal Variability	Medium	The study collected 888 house dust samples, however they did not collect replicate samples.
Metric 7:	Exposure Scenario	Medium	The exposure scenario is relevant.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	The authors report the detection frequency, min, max, 25 and 75%. They also reported the number of samples in the data set. No standard deviation was reported, nor individual concentrations.
Metric 9:	Quality Assurance	Medium	The authors refer to another paper regarding their quality control and assurance methods.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	The authors address limitations of the study, variance was reported in terms of percentiles.

Overall Quality Determination   **Medium**

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

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

Overall Quality Determination   Medium

Study Citation:	Paluselli, A., Fauvelle, V., Schmidt, N., Galgani, F., Net, S., Sempéré, R. (2018). Distribution of phthalates in Marseille Bay (NW Mediterranean Sea). Science of the Total Environment 621:578-587.		
HERO ID:	4829461		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	The sampling method is clear and appropriate, and includes details such as sample storage, sample storage duration and sampler calibration.
	Metric 2: Analytical Methodology	High	The analytical methodology is clear and appropriate. A range of LODs is provided for the chemicals.
	Metric 3: Biomarker Selection	N/A	Study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Samples were collected in Marseille Bay, France.
	Metric 5: Currency	Medium	Samples were collected from Dec 2013 to Nov 2014.
	Metric 6: Spatial and Temporal Variability	High	A total of 72 water samples were collected monthly at multiple seawater depths of 0.5, 5, 15 and 30 meters for surface and bottom seawater level sampling over a period of one year. Duplicate samples were reported.
	Metric 7: Exposure Scenario	High	The exposure scenario is surface water in a bay in France at various depths. The scenario is well characterized with details such as the microclimate and potential sources provided.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Concentrations of chemical were provided in Table 1, including range, average, and standard deviation. No raw data was provided.
	Metric 9: Quality Assurance	Medium	QA/QC measures are reported, including the use of a method blank and a spike blank. No major issues were identified. It was noted that occasionally DiBP, DBP and DEHP were detected in blanks but in concentrations that were below the limits of detection.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	High	Standard deviations are provided in Table 1 and there is discussion of variability and uncertainty in the results and discussion section.

Overall Quality Determination   High

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 stated.
	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 in 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:	Okeme, J. O., Nguyen, L. V., Lorenzo, M., Dhal, S., Pico, Y., Arrandale, V. H., Diamond, M. L. (2018). Polydimethylsiloxane (silicone rubber) brooch as a personal passive air sampler for semi-volatile organic compounds. Chemosphere 208:1002-1007.		
HERO ID:	5017615		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Personal air sampling methodology described within text as incorporating passive polydimethylsiloxane brooch samplers worn within breathing zone of participants, samples stored in air tight glass jars and frozen pending analysis, extensive calibration study of passive samplers compared with active sampling pumps conducted prior to field study described with field study conducted on participants instructed to stay indoors unless going to/from work. Insufficient information on sample storage time prior to analysis. Sampling methodology within field study unclear as to distribution/collection times of passive samplers—it is unclear if passive sampling brooches were collected daily or if single brooches were worn for seven consecutive days.
	Metric 2:	Analytical Methodology	Medium	Extraction methods and analytical instrumentation as GC-MS/ENCI described with data on detection limits and recovery samples described within SI and noted to have met criteria from previous references (Saini et al., 2015; Okeme et al., 2016b). Insufficient information on instrument calibration, although this information may be provided within SI.
	Metric 3:	Biomarker Selection	N/A	Personal passive air sampling results with brooch and active sampling pump for parent chemicals of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Canada.
	Metric 5:	Currency	High	Sampling conducted in winter of 2016.
	Metric 6:	Spatial and Temporal Variability	Low	Field study consisted of three volunteers wearing badges for seven days with unclear methodology description of when/if passive sampling brooches were retrieved and replaced daily or if a single brooch was worn for 24 hours during seven day period. No duplicate/replicate sampling conducted, however 24-hour sampling conducted.
	Metric 7:	Exposure Scenario	Medium	Participants are office workers who were instructed to remain indoors (work/home) for the period of study other than transportation to/from work.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data in terms of passive personal brooch sampling results for each participant reported within Table 1, with additional data from calibration in SI. Insufficient information on exact sampling dates, although sampling reported as conducted during "winter of 2016". Insufficient information on summary statistics as only single brooch concentrations, without range, number of brooches, etc. provided. Frequency of detection information described as detailed within SI.
	Metric 9:	Quality Assurance	Medium	Recovery and QC data described as detailed within SI (S3). Results described as blank and recovery corrected as appropriate. Pre-exposure sampling not conducted.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Insufficient information on variability characterization as no range or SD information provided for sampling results. Limitations of small sample size (n=3 participants for field study) as well as lack of individual activity data noted. Some uncertainty with effects of humidity on passive sampling brooch while left within bathroom during shower/bathing activities not noted by authors.

Overall Quality Determination   Medium

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

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

Overall Quality Determination   Medium

Study Citation:	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:	Martinez, R. M., Hauser, R., Liang, L., Mansur, A., Adir, M., Dioni, L., Racowsky, C., Bollati, V., Baccarelli, A. A., Machtinger, R. (2019). Urinary concentrations of phenols and phthalate metabolites reflect extracellular vesicle microRNA expression in follicular fluid. Environment International 123:20-28.		
HERO ID:	5041241		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	The urine sampling methodology was described in detail and is scientifically sound.
	Metric 2: Analytical Methodology	Medium	The analytical methods were described and included LODs but did not include recoveries.
	Metric 3: Biomarker Selection	High	The metabolites closely represent exposure to phthalates.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	The samples were collected in Israel
	Metric 5: Currency	High	The samples were collected between 2014 and 2016.
	Metric 6: Spatial and Temporal Variability	Low	n=130, some study participants provided duplicate samples.
	Metric 7: Exposure Scenario	High	The data closely represent relevant scenarios related to phthalate exposure
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Only summary statistics were reported (median, IQR, max)
	Metric 9: Quality Assurance	Medium	QA/QC techniques were mentioned but not described in detail.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	High	Variability was characterized (IQR, max). Uncertainties and study limitations were discussed.

Overall Quality Determination   High

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

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

Overall Quality Determination   Medium

Study Citation:		Velázquez-Gómez, M., Hurtado-Fernández, E., Lacorte, S. (2019). Differential occurrence, profiles and uptake of dust contaminants in the Barcelona urban area. Science of the Total Environment 648:1354-1370.		
HERO ID:		5043338		

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Dust sampling methods were included and described (Velázquez-Gómez et al., 2018). Sample collection was performed by gently collecting the accumulation of the settled dust. In houses, cars and in the public places where we had access, the samples were collected by scientific staff with a Bosch BKS4 (14.4 V) vacuum cleaner.
	Metric 2:	Analytical Methodology	Medium	GC-EI-MS/MS analysis. All QA/QC measures reported except reporting limits were not reported in the text.
	Metric 3:	Biomarker Selection	N/A	They did not test for biomarkers; tested for parent chemicals in dust samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected in Spain.
	Metric 5:	Currency	Low	Sampling date was not reported, but publication date is available, 2019.
	Metric 6:	Spatial and Temporal Variability	Medium	Authors did not collect replicate samples.
	Metric 7:	Exposure Scenario	Medium	Table 1 presents sample site characteristics, but does not include indoor characteristics such as air flow.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Authors did not calculate standard deviation or other measure of variation (besides IQR).
	Metric 9:	Quality Assurance	Medium	QA/QC techniques were discussed, but authors did not report sample recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Authors provided limited discussion on key data uncertainties.

Overall Quality Determination   Medium

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

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Some sampling methods not reported such as sampler calibration
Metric 2:	Analytical Methodology	Medium	Recovery samples not reported
Metric 3:	Biomarker Selection	High	Acceptable biomarker
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	United States
Metric 5:	Currency	Low	Samples collected between 1993 and 1998
Metric 6:	Spatial and Temporal Variability	High	>10 samples; replicates
Metric 7:	Exposure Scenario	High	Exposure sources characterized
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Raw data not reported
Metric 9:	Quality Assurance	Medium	Key QA reported
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Some limitations reported

Overall Quality Determination   Medium

Study Citation:	Rabhi, L., Lemou, A., Cecinato, A., Balducci, C., Cherifi, N., Ladji, R., Yassaa, N. (2018). Polycyclic aromatic hydrocarbons, phthalates, parabens and other environmental contaminants in dust and suspended particulates of Algiers, Algeria. Environmental Science and Pollution Research 25(24):24253-24265.		
HERO ID:	5043419		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Detailed sampling methodology.
	Metric 2:	Analytical Methodology	High	Includes LOD and LOQ.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Algeria
	Metric 5:	Currency	High	Samples from 2016.
	Metric 6:	Spatial and Temporal Variability	High	Includes replicates, 36 indoor samples, 92 outdoor samples.
	Metric 7:	Exposure Scenario	High	Data closely represents a relevant exposure scenario.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data nor reported, only summary statistics.
	Metric 9:	Quality Assurance	High	Controls and recovery samples were analyzed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Key uncertainties and limitations are not discussed.

Overall Quality Determination   **High**

Study Citation:	Rodríguez-Carmona, Y., Cantoral, A., Trejo-Valdivia, B., Téllez-Rojo, M. M., Svensson, K., Peterson, K. E., Meeker, J. D., Schnaas, L., Solano, M., Watkins, D. J. (2019). Phthalate exposure during pregnancy and long-term weight gain in women. Environmental Research 169:26-32.		
HERO ID:	5043451		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Only briefly described.
	Metric 2:	Analytical Methodology	High	Well described analytical methods, reported LOD in supplemental material.
	Metric 3:	Biomarker Selection	High	Biomarker is known to be related to external exposure.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Mexico
	Metric 5:	Currency	Low	Sampling began in 1997.
	Metric 6:	Spatial and Temporal Variability	Low	n=178, with 4 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	Medium	Limited description about QA/QC techniques.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Characterized variability, discussed uncertainties and limitations.

Overall Quality Determination   Medium

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

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

Overall Quality Determination   **Medium**

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

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methodology does not represent best protocols. Participants were instructed to collect urine "in a clean plastic container," transfer into a study-provided bottle, then stored in their home refrigerator "or other cool place" for an unspecified amount of time. Additionally, many participants did not include all four requested samples (three first morning voids and one 24-hour) and the selection of samples to analyze from the provided number is unclear.
	Metric 2:	Analytical Methodology	High	Samples were analyzed at a CDC laboratory following methodology that is well-established and reliable. Analyte LOD is provided.
	Metric 3:	Biomarker Selection	Low	Two monoester phthalates are metabolites for the parent molecule of interest, and there is no stated method to quantify exposure for the molecule of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	California
	Metric 5:	Currency	Medium	2007-2014
	Metric 6:	Spatial and Temporal Variability	Medium	178 mothers (188 pregnancies) were instructed to provided four urine samples each: first morning void urine samples once per week for three weeks, and one 24-hour urine sample on the fourth week. However, many participants did not provide all requested samples; the selection of samples to analyze from the provided number favored first-morning voids and is otherwise unclear.
	Metric 7:	Exposure Scenario	Medium	Biomonitoring
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics for analyte concentration include 5th, 25th, 50th, 75th, and 95th percentile, as well as maximum and geometric mean. Individual concentration values are not reported.
	Metric 9:	Quality Assurance	High	Samples were analyzed at a CDC laboratory following protocols that are well-established to be precise and reproducible, including in-study assurances.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variability between sample types (pooled vs. individual) and across trimesters is thoroughly discussed and analyzed.

Overall Quality Determination   Medium

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:	Sulentic, R. O., Dumitrascu, I., Deziel, N. C., Gurzau, A. E. (2018). Phthalate Exposure from Drinking Water in Romanian Adolescents. International Journal of Environmental Research and Public Health 15(10):2109.		
HERO ID:	5043505		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Sampling methods described, including sample procedures, storage, and equipment for tap water, representative bottled water, and first morning urine samples.
Metric 2:	Analytical Methodology	Medium	Analytic methodology described, including detection limits, analytical instrumentation, and extraction. Tap and bottled water samples analyzed according to ISO 18856, 2006 method. Urine specimens analyzed according to modified (unclear what was modified) Kim (2014) referenced study methods, along with creatinine analyses.
Metric 3:	Biomarker Selection	High	Sampling for metabolites specific for parent chemical of interest in urine and measured the parent chemical in water.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Samples provided by participants in Cluj-Napoca, Romania.
Metric 5:	Currency	High	Samples collected during the summer months of June and July of 2017.
Metric 6:	Spatial and Temporal Variability	Medium	Single first morning urine samples (not 24-hour samples) collected for 40 participants during a single season (summer) of a single year (2017). Only 10 tap water samples collected for 40 participants, and 16 bottled water concentrations reported. No replicates reported.
Metric 7:	Exposure Scenario	High	This is a biomonitoring (urine) study where exposure was assessed through sampling of tap and bottled water.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Summary statistics included median, 25th and 75th percentiles. Raw data not provided.
Metric 9:	Quality Assurance	Medium	Quality assurance procedures described, including blank and a laboratory control. No discussion of recoveries.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Characterized variability through tap and bottled water concentrations. Urinary concentrations reported across water consumption behaviors, consumer product use and demographics, as well as sample storage conditions. Potential study limitations and variability in results compared with previously reported studies presented.

Overall Quality Determination   High

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 sitesWS1–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:	van't Erve, T. J., Rosen, E. M., Barrett, E. S., Nguyen, R. H. N., Sathyanarayana, S., Milne, G. L., Calafat, A. M., Swan, S. H., Ferguson, K. K. (2019). Phthalates and phthalate alternatives have diverse associations with oxidative stress and inflammation in pregnant women. Environmental Science & Technology 53(6):3258-3267.		
HERO ID:	5043603		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Sampling methodology was briefly described, except sample storage duration prior to analysis. Most key elements were outlined herein, with a more thorough discussion referenced in a separate paper.
	Metric 2: Analytical Methodology	Medium	The analytical methodology was briefly described. Specific limits of detection appear in Table 3. There was no calibration or recovery data, but analytic methods were referenced, and there was a reference to quality control samples.
	Metric 3: Biomarker Selection	High	Sampling was for metabolites specific to this parent chemical.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Samples were provided by participants in California, Minnesota, New York, and Washington State.
	Metric 5: Currency	Medium	Samples were collected in 2010-2012.
	Metric 6: Spatial and Temporal Variability	Low	Participants in their first trimester recruited from California, Minnesota, New York, and Washington State during 2010-2012; single spot urines during third trimester period provided by n=762 participants. They used a non-statistical sampling methodology. There was no mention of replicates or duplicates. Rated low because they appeared to use un-pooled spot samples.
	Metric 7: Exposure Scenario	Medium	Some participant characteristics were described, but they did not use a detailed questionnaire with information about potential sources of exposures.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Raw data were not provided, but the mean, SD, and 25th/50th/765th/90th percentile result were included. This study measured certain biomarkers of oxidative stress alongside concentrations of phthalates.
	Metric 9: Quality Assurance	Medium	The authors noted: "Quality control samples were analyzed with each batch with coefficients of variation within the expected range (CV = 3−7%)." Also, they corrected for urinary specific gravity. Other discussion of quality assurance procedures was missing, such as recoveries. No pre-exposure samples were available.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Variability was described using statistical data. Potential study limitations, including sources of uncertainty, were briefly described.

Overall Quality Determination   **Medium**

Study Citation:	Berardi, C., Fibbi, D., Coppini, E., Renai, L., Caprini, C., Scordo, C. V. A., Checchini, L., Orlandini, S., Bruzzoniti, M. C., Del Bubba, M. (2019). Removal efficiency and mass balance of polycyclic aromatic hydrocarbons, phthalates, ethoxylated alkylphenols and alkylphenols in a mixed textile-domestic wastewater treatment plant. Science of the Total Environment 674(Elsevier):36-48.	
HERO ID:	5119787	

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Sampling and sampling equipment was described in detail with WWTP sampled during two weeks in summer using bottles and 24-h composite sampling using autosamplers. Samples were stored at 4C and analyzed within 48 hours and filtered.
Metric 2:	Analytical Methodology	Low	Analytical methodology was described as utilizing EPA 3535A SPE method with GC-MS with recoveries noted and described within SI. Detection limits were not reported for this chemical in the main text, but may be within the SI.
Metric 3:	Biomarker Selection	N/A	Sampling was conducted in environmental media.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Sampling was conducted in Prato, Italy.
Metric 5:	Currency	Medium	Sampling was conducted in 2011.
Metric 6:	Spatial and Temporal Variability	High	Seven samples were collected from one WWTP for each of two series for a total of n=14 samples during a 2 week period in summer.
Metric 7:	Exposure Scenario	High	Concentrations in influent and effluent were sampled from a well-described WWTP area of an industrial textile district in Italy.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Low	Influent and effluent mean relative percentages with standard deviations were depicted in Fig2b, however raw data is not reported.
Metric 9:	Quality Assurance	Medium	Recovery range was provided in Section 2.4; Quality control was also implied via use of the EPA methods.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Standard deviations were reported in Figure 2B however study limitations were not discussed in detail.

Overall Quality Determination   **Medium**

Study Citation:	Li, Q., Xu, X., Fang, Y., Xiao, R., Wang, D., Zhong, W. (2018). The temporal changes of the concentration level of typical toxic organics in the river sediments around Beijing. Frontiers of Environmental Science & Engineering 12(6):8.		
HERO ID:	5154880		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Sampling methods were adequately reported. Sampler calibration is not applicable because of grab sampling.
Metric 2:	Analytical Methodology	High	Key analytical methods (e.g., extraction, instrumentation, detection limits in Table S5) were reported.
Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in river sediment.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Samples were collected in Beijing, China.
Metric 5:	Currency	High	Samples collected in October 2016
Metric 6:	Spatial and Temporal Variability	Medium	There were 5 sampling sites, but it is unclear how many samples were collected from each site. No replicates were reported.
Metric 7:	Exposure Scenario	High	Samples were collected from rivers that are used for either drinking or irrigation, which is relevant to human exposure.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Raw data were not provided.
Metric 9:	Quality Assurance	High	QA/QC protocols included blanks and recoveries, which were acceptable.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	Gaps and limitations were not reported. There was only a minimal characterization of variance.

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:	Ren, Y. Q., Wang, G. H., Li, J. J., Wu, C., Cao, C., Li, J., Wang, J. Y., Ge, S. S., Xie, Y. N., Li, X. R., Meng, F., Li, H. (2019). Evolution of aerosol chemistry in Xi'an during the spring dust storm periods: Implications for heterogeneous formation of secondary organic aerosols on the dust surface. Chemosphere 215:413-421.		
HERO ID:	5380289		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	sampling methodology described,
	Metric 2: Analytical Methodology	Medium	Detailed analytical procedure has been published elsewhere (Li et al., 2018; Ren et al., 2017a). detector described, LOD not described
	Metric 3: Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	China
	Metric 5: Currency	Medium	2013
	Metric 6: Spatial and Temporal Variability	Medium	Dust storm(n=27)Transition(n=15)Non-dust storm(n=22); no replicates
	Metric 7: Exposure Scenario	Medium	rooftop of a three-story building on the campus of Institute of Earth Environment in Xi'an
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	mean, SD, range provided
	Metric 9: Quality Assurance	Medium	Quality assurance not discussed, no obvious concerns
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	hourly variations considered, range of concentrations provided

Overall Quality Determination   Medium

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:	Giovanoulis, G., Nguyen, M. A., Arwidsson, M., Langer, S., Vestergren, R., Lagerqvist, A. (2019). Reduction of hazardous chemicals in Swedish preschool dust through article substitution actions. Environment International 130:104921.		
HERO ID:	5412073		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Reported key sampling details and cited sampling method previously were described in Papadopoulou et al., 2016 (reference not obtained).
	Metric 2: Analytical Methodology	High	Extraction and analytical methods were well-described; collected replicate samples from each preschool; reported detection limits in Table 1; analyzed the standard reference material (SRM) 2585 (NIST, USA) each time in replicate (n=4) to evaluate accuracy of the analytical method.
	Metric 3: Biomarker Selection	N/A	The analytes were collected as dust samples; biomarker samples were not collected.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	The samples were collected in Stockholm area, Sweden.
	Metric 5: Currency	High	Dust sampling took place from January to February 2018.
	Metric 6: Spatial and Temporal Variability	High	The study had a sample size of n=20 and replicate samples from each pre-school. The study collected dust at one point in time (2018), but compared current dust contaminant concentrations to prior concentrations to examine the impact of implementation of "chemical smart" actions.
	Metric 7: Exposure Scenario	High	The study collected questionnaire data during sampling to capture information on indoor materials, daily cleaning routines and ventilation function. It also examined association between dust and indoor parameters to understand product sources of exposure.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Raw data were not reported in main text (does not seem to be reported in SI either, but SI file was not obtained). The standard deviation of summary statistics was not reported in main text.
	Metric 9: Quality Assurance	High	The study analyzed solvent and field blanks. It reported adequate (>70%) sample recoveries; results were in good agreement with previously reported values in the literature.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	High	The study accounted for variability between chemicals and floor materials (boxplot distributions presented in Fig 1). It discussed key limitations and uncertainties, which likely underestimated risk to children specifically.

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:	Luongo, G., Oestman, C. (2016). Organophosphate and phthalate esters in settled dust from apartment buildings in Stockholm. Indoor Air 26(3):414-425.		
HERO ID:	5469670		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Sampling of indoor dust on tops of shelves and furniture as well as indoor air was described. Some criteria were not mentioned like sample storage conditions (may be listed in a referenced study, Bergh et al. (2010, 2011a,b, 2012)).
Metric 2:	Analytical Methodology	Medium	Some analytic methodology criteria details were not mentioned, such as instrument calibration (but may be described in a referenced study). LOD's were reported.
Metric 3:	Biomarker Selection	N/A	Sampling was conducted for parent chemicals of interest in environmental media.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Sampling was conducted in Stockholm, Sweden.
Metric 5:	Currency	Medium	Data was collected in 2008.
Metric 6:	Spatial and Temporal Variability	High	Indoor dust samples were collected in 2008 from 62 apartments in 19 different buildings in the Stockholm city area at a height of 0.8 meters from surfaces of furniture and frames of windows and doors. Indoor air sampling was conducted for 24-hours with duplicate active air samples positioned within a central location in each apartment on the same day as dust sampling.
Metric 7:	Exposure Scenario	Medium	Source of exposure and population exposed were detailed. There were no exposure controls used.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	High	Raw data was reported in Table S1. Some summary statistics included 25th percentile, median, 75th percentile, and range. Detection frequencies were reported.
Metric 9:	Quality Assurance	High	QC details were described and included laboratory blanks. Standard reference materials were utilized for quality control samples. Baseline, pre-exposure sampling was not conducted.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	No limitations were described. Variations in toddler and adult exposure was studied.

Overall Quality Determination   High

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:	Shan, X. M., Wang, B. S., Lu, B. B., Shen, D. H. (2016). [Investigation of pollution of phthalate esters and bisphenols in source water and drinking water in Hefei City, China]. Huanjing yu Zhiye Yixue / Chinese Journal of Environmental & Occupational Medicine 33(4):350-355.		
HERO ID:	5491666		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methods were described but barely.
	Metric 2:	Analytical Methodology	Low	The only description of analytical methods is as follows: sample preparation was solid phase extraction and determination by GS-MS. Detection limits were reported though.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in source and drinking water.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Hefei (China).
	Metric 5:	Currency	Medium	Samples were collected in 2012.
	Metric 6:	Spatial and Temporal Variability	High	There were 10 sampling sites where parallel samples were taken from each.
	Metric 7:	Exposure Scenario	High	The measurement of phthalates in source and drinking water is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Mean concentrations and raw data are available in Table 1.
	Metric 9:	Quality Assurance	Low	Other than reporting recoveries (all >84%), no other QA/QC methods were discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Characterization of variance is missing, but raw data area available. There was no discussion of limitations, gaps, and uncertainties either.

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

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methods not reported, such as sampler calibration.
	Metric 2:	Analytical Methodology	High	Key analytical methods reported.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Taiwan
	Metric 5:	Currency	Medium	Samples collected in 2014.
	Metric 6:	Spatial and Temporal Variability	High	>10 samples collected; replicates.
	Metric 7:	Exposure Scenario	Medium	Exposure source not well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported.
	Metric 9:	Quality Assurance	Medium	QA conducted but reported in a different study.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported.

Overall Quality Determination   Medium

Study Citation:	Shao, X. L., Zou, Y. M., Wang, F. X., Zhang, Z., Wang, S. M., Han, S. L., Wang, S. S., Chen, Y., Wu, X. Y., Chen, Z. L. (2013). Determination of phthalate acid esters in water and sediment samples by GC-MS. Advanced Materials Research 610-613:157-162.		
HERO ID:	5495649		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Surface water (3 from Yangtze River, 1 from Tongji River), sediment (2 from Yangtze), and tap water (from laboratory) were sampled in autumn. Water samples were filtered. Sediment were freeze-dried and extracted overnight. Sampling equipment and storage were not specified.
Metric 2:	Analytical Methodology	Medium	Solid phase extraction was used for water samples, and ultrasonic-associated solvent extraction for soil. Samples were analyzed with GC-MS. Recoveries were reported. LODs for all analytes were only reported as a range (0.103-0.373 ug/L for water and .232-0.572 mg/kg for sediment).
Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in water and sediment.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Samples were collected from the Zhenjiang section of the lower reach of Yangtze River as well as Jiangsu Province for Tongji River, China.
Metric 5:	Currency	Medium	Samples were collected in 2011.
Metric 6:	Spatial and Temporal Variability	Low	Sample size is small for each scenario. Water was samples from only 3 sites in Yangtze River (upstream, midstream, downstream) and 1 site in Tongji river. There was only one tap water sample from the laboratory. Sediment samples were collected from 2. Surface water and sediment were sampled in autumn only.
Metric 7:	Exposure Scenario	High	Water and sediment were sampled from rivers in China that are located in highly developed industry and agriculture areas.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Table 4 provides concentrations in water from each sampling location (100% DF); Table 5 provides concentration in sediments by sample site. Most summary statistics are missing.
Metric 9:	Quality Assurance	High	QA/QC was reported, including blanks, triple samples, and recoveries. Recoveries were provided in Table 3, and are acceptable for the phthalates of interest.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	Variance was not reported, and neither were limitations, data gaps, or uncertainties.

Overall Quality Determination   Medium

Study Citation: Guo, Y., Weck, J., Sundaram, R., Goldstone, A. E., Louis, G. B., Kannan, K. (2014). Urinary Concentrations of Phthalates in Couples Planning Pregnancy and Its Association with 8-Hydroxy-2'-deoxyguanosine, a Biomarker of Oxidative Stress: Longitudinal Investigation of Fertility and the Environment Study. Environmental Science & Technology 48(16):9804-9811.

HERO ID: 5529569

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Some sampling methods were described, but reference to a previously published study was provided for more details. There was no information on when urine samples were collected by participants.
	Metric 2:	Analytical Methodology	Medium	Analytical methods were described, but LOQs was only reported as a range for all phthalates.
	Metric 3:	Biomarker Selection	High	MiBP is specific to DiBP.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected in Michigan and Texas.
	Metric 5:	Currency	Medium	Samples collected during 2005-2009.
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates were reported among the 849 urine samples. It is also unclear if the urine samples were spot or pooled.
	Metric 7:	Exposure Scenario	High	This is a biomonitoring study where exposure is presumed to occur through phthalates' ubiquity commercial and personal care products.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data were available.
	Metric 9:	Quality Assurance	High	QA/QC techniques were described, and samples were creatinine adjusted.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was characterized. Uncertainties and limitations were not discussed

Overall Quality Determination   High

Study Citation:	Promtes, K., Kaewboonchoo, O., Kawai, T., Miyashita, K., Panyapinyopol, B., Kwonpongsagoon, S., Takemura, S. (2019). Human exposure to phthalates from house dust in Bangkok, Thailand. Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 11(13):1-7.		
HERO ID:	5532759		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sample methodology was succinctly summarized including a reference to previously published protocol for more details.
	Metric 2:	Analytical Methodology	High	Extract method, GC/MS, LOD, and recoveries were all reported.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in household dust.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected from homes in Bangkok, Thailand.
	Metric 5:	Currency	High	Samples were collected in 2017.
	Metric 6:	Spatial and Temporal Variability	Medium	No replicate samples were collected.
	Metric 7:	Exposure Scenario	High	Exposure to phthalates via household dust is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data were reported.
	Metric 9:	Quality Assurance	Medium	There is some discussion of QA/QC with spiked samples, triplicate measurements, and recoveries (acceptable).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variance was characterized with a range. Discussion of limitations was very brief.

Overall Quality Determination   High

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

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

Overall Quality Determination   High

Study Citation:	Garí, M., Koch, H. M., Pälmke, 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 MiBP and OH-MiBP
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 (in μg/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:	Schecter, 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:	Mouritsen, A., Frederiksen, H., Sørensen, K., Aksglaede, L., Hagen, C., Skakkebaek, N. E., Main, K. M., Andersson, A. M., Juul, A. (2013). Urinary phthalates from 168 girls and boys measured twice a year during a 5-year period: Associations with adrenal androgen levels and puberty. Journal of Clinical Endocrinology and Metabolism 98(9):3755-3764.		
HERO ID:	5541110		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Population characteristics, sampling collection for first morning urine samples, storage condition, and sample preparation were described.
	Metric 2: Analytical Methodology	High	LC-MS/MS was used for analysis. LOD was provided.
	Metric 3: Biomarker Selection	Low	While MBP is specific to DBP, authors noted that they combined MiBP and MnBP and expressed it as the sum of MBP isomers. It is therefore unclear what percentage is derived from exposure to DiBP vs DnBP.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Study was conducted in the Copenhagen area of Denmark.
	Metric 5: Currency	Medium	The study was conducted during 2006-2010.
	Metric 6: Spatial and Temporal Variability	Medium	A total number of 792 (boys and girls) urinary samples were presented in the supplementary table 1 without replicates.
	Metric 7: Exposure Scenario	Medium	This is a biomonitoring study but there was no discussion about suspected sources of exposure, not even speaking generally from phathlates' ubiquity.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Individual data were not reported. Mean concentrations and coefficient of variance were reported for each analyte in Table S1.
	Metric 9: Quality Assurance	Medium	Quality assurance was reported to be conducted, though description was referred to elsewhere. Recoveries were all above 89%.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	High	Limitations were described in the study, which were mainly on the variations in the volume, and time of collection of urinary samples. Variance characterized by range in Table S1.

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: Weiss, J. M., Gustafsson, Å., Gerde, P., Bergman, Å., Lindh, C. H., Krais, A. M. (2018). Daily intake of phthalates, MEHP, and DINCH by ingestion and inhalation. Chemosphere 208:40-49.

HERO ID: 5550408

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The study authors reported some sampling methods. Some methods were not reported such as sample storage conditions.
	Metric 2:	Analytical Methodology	Medium	The study authors reported the LOD. Recovery samples were not reported.
	Metric 3:	Biomarker Selection	N/A	Study looked at chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in Sweden.
	Metric 5:	Currency	Low	The date of sample collection was not reported for pooled samples. Individual dust samples were part of 2012 MiSSE project.
	Metric 6:	Spatial and Temporal Variability	Medium	For pooled samples there were 61 samples collected in total but pooled across three locations. For individual samples there were 10 samples for living rooms and 5 samples for children's rooms.
	Metric 7:	Exposure Scenario	Medium	This was a monitoring study and did not examine specific sources of exposure.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data were reported in the supplementary materials.
	Metric 9:	Quality Assurance	High	The study authors reported 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   Medium

Study Citation:	Molbert, N., Alliot, F., Santos, R., Chevreuil, M., Mouchel, J. M., Goutte, A. (2019). Multiresidue Methods for the Determination of Organic Micropollutants and Their Metabolites in Fish Matrices. Environmental Toxicology and Chemistry 38(9):1866-1878.		
HERO ID:	5555943		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Key sampling methods reported
	Metric 2: Analytical Methodology	High	Key analytical methods reported
	Metric 3: Biomarker Selection	Medium	Acceptable biomarker
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	France
	Metric 5: Currency	High	Samples collected in 2016
	Metric 6: Spatial and Temporal Variability	High	>5-10 samples; replicates of chub muscle and liver
	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	QA reported
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Few gaps and limitations reported

Overall Quality Determination   High

Study Citation:	Polyakova, O. V., Artaev, V. B., Lebedev, D. T. (2018). Priority and emerging pollutants in the Moscow rain. Science of the Total Environment 645:1126-1134.		
HERO ID:	5576453		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Sampling methods were described in detail. Sample preparation was carried out according to the US EPA 8270D Method.
Metric 2:	Analytical Methodology	Low	Analytical methods were sufficiently described. LOD not reported.
Metric 3:	Biomarker Selection	N/A	Parent chemical measured in rainwater.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Samples collected in Moscow.
Metric 5:	Currency	High	The samples were collected in the period between April 7 and May 15, 2017.
Metric 6:	Spatial and Temporal Variability	Medium	8 rain samples collected. No replicates mentioned.
Metric 7:	Exposure Scenario	High	Ambient samples of rainwater collected in 2 locations in Moscow..
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	High	Raw data reported.
Metric 9:	Quality Assurance	High	Key QA reported including use of blanks and recoveries.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	No limitations or variability mentioned.

Overall Quality Determination   High

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

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

Overall Quality Determination   **High**

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

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

Overall Quality Determination   High

Study Citation: 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: | 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: Puklová, V., Janoš, T., Sochorová, L., Vavrouš, A., Vrbík, K., Fialová, A., Hanzlíková, L., Černá, M. (2019). Exposure to mixed phthalates in Czech preschool and school children. Archives of Environmental Contamination and Toxicology 77(4):1-9.

HERO ID: 5630466

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Authors described study population, collection procedure, equipment, and storage. Note that some components of sampling methodology are not relevant to urine collection (e.g., sampler calibration).
	Metric 2: Analytical Methodology	Medium	Some analytical methods were not reported such as recovery samples.
	Metric 3: Biomarker Selection	High	MiBP is specific to DiBP.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Samples were collected in Czech Republic.
	Metric 5: Currency	High	Samples were collected between 2016 and 2017.
	Metric 6: Spatial and Temporal Variability	Medium	A total of 370 samples were collected without replicates and only first morning void.
	Metric 7: Exposure Scenario	High	Children's exposure to the countless products containing phthalates, as measured in this biomonitoring study, is relevant.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Raw data were not reported.
	Metric 9: Quality Assurance	Low	QA/QC protocol was not reported but implied through its use of the National Institute of Public Health Laboratory in Prague.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Variance characterized by range. Some gaps and limitations were reported.

Overall Quality Determination   High

Study Citation:	Li, J., Xia, W., Wu, C., Zhao, H., Zhou, Y., Wei, J., Ji, F., Luan, H., Xu, S., Cai, Z. (2019). Variations of phthalate exposure and metabolism over three trimesters. Environmental Pollution 251(Elsevier):137-145.		
HERO ID:	5692137		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Most key criteria were met. Specifics on equipment and duration of sample storage prior to analysis were lacking.
Metric 2:	Analytical Methodology	Medium	Most key criteria met, including reference to previously published protocols. However, LODs were reported as a range.
Metric 3:	Biomarker Selection	High	MiBP is specific to DiBP.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Samples provided by participants in Wuhan City, China.
Metric 5:	Currency	Medium	Samples collected 2014-2015.
Metric 6:	Spatial and Temporal Variability	Medium	Multiple samples provided by 946 participants over three trimesters of pregnancy for a total of n=2838 samples. Samples provided only by participants in one city.
Metric 7:	Exposure Scenario	Medium	Participant characteristics reported in Table 1.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	No raw data were provided.
Metric 9:	Quality Assurance	Medium	Some quality assurance procedures were reported, such as recovery which were acceptable and adjustments for urine dilution.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	There was no discussion of limitations, uncertainties. and gaps.

Overall Quality Determination   **Medium**

Study Citation:	Buckley, J. P., Engel, S. M., Mendez, M. A., Richardson, D. B., Daniels, J. L., Calafat, A. M., Wolff, M. S., Herring, A. H. (2016). Prenatal phthalate exposures and childhood fat mass in a New York City cohort. Environmental Health Perspectives 124(4):507-513.		
HERO ID:	5699787		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Limited description of sampling methods
	Metric 2:	Analytical Methodology	Medium	Authors did not described laboratory methods aside from citing previously reported methods. LODs reported in Table 2.
	Metric 3:	Biomarker Selection	High	Biomarker (MiBP) is known to be related with external exposure to DiBP.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected from a cohort in New York City.
	Metric 5:	Currency	Low	Sampling began in 1998 until 2002.
	Metric 6:	Spatial and Temporal Variability	Low	Maternal urine samples (spot only) totaled 404, and 180 children were evaluated. There was no report of replicates.
	Metric 7:	Exposure Scenario	High	Data closely represents relevant exposure scenarios (e.g., biomonitoring study).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics were provided and not raw data.
	Metric 9:	Quality Assurance	Low	Limited description of QA/QC techniques besides citing another paper that explained their methods.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was characterized, but uncertainties and limitations were not discussed.

Overall Quality Determination   Medium

Study Citation:	Hurford, N., Law, R. J., Payne, Fileman, T. W. (1989). Concentrations of chemicals in the North Sea arising from discharges from chemical tankers. Oil and Chemical Pollution 5(6):391-410.		
HERO ID:	5739457		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	sampling details of position and location Table 3 and Fig 1; 3 water samples (2x2.7 L and 1x1L) at each 32 location from windward side at 5m by glass bottles; storage conditions/duration not discussed
	Metric 2: Analytical Methodology	Medium	extracted with dichlormetane; GC/MS; Table 5 provides LOD; recoveries not discussed
	Metric 3: Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	North Sea
	Metric 5: Currency	Low	1986
	Metric 6: Spatial and Temporal Variability	High	3 water samples taken from each 32 sampling stations between 21 and 27 of April
	Metric 7: Exposure Scenario	High	sampling concentrations of chemicals in the North Sea to which operational discharges from chemical tankers would be expected to contribute
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Table 7 provides concentration of at each sampling location
	Metric 9: Quality Assurance	Medium	Section 6.3; procedural blanks; no discussion of recoveries
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	discusses limitation in data to make possible explanation of differences between locations

Overall Quality Determination   **Medium**

Study Citation:	Machtinger, R., Mansur, A., Baccarelli, A. A., Calafat, A. M., Gaskins, A. J., Racowsky, C., Adir, M., Hauser, R. (2018). Urinary concentrations of biomarkers of phthalates and phthalate alternatives and IVF outcomes. Environment International 111:23-31.		
HERO ID:	5743382		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Well described sampling methods.
Metric 2:	Analytical Methodology	Medium	Limited description, cited previously published work, reported LOD.
Metric 3:	Biomarker Selection	High	Known metabolites resulting from external exposure.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Israel
Metric 5:	Currency	High	Sampling began in 2014, finished in 2016.
Metric 6:	Spatial and Temporal Variability	Low	136 samples, no replicates.
Metric 7:	Exposure Scenario	Medium	Did not discuss relation to exposure sources.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Only summary statistics.
Metric 9:	Quality Assurance	Low	QA/QC not directly discussed.
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:	SUNY, (2018). The effect of air change rate and temperature on phthalate concentration in house dust. Science of the Total Environment 639:760-768.		
HERO ID:	5744397		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	The sampling methodology is thoroughly described and scientifically sound.
Metric 2:	Analytical Methodology	Low	The analytical methodology is thoroughly described and scientifically appropriate. The LOD is not provided.
Metric 3:	Biomarker Selection	N/A	Study is testing for concentration in house dust.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Samples were collected in China.
Metric 5:	Currency	High	Samples were collected from 2016 to 2017.
Metric 6:	Spatial and Temporal Variability	High	20 samples were collected from each location.
Metric 7:	Exposure Scenario	High	The exposure scenario of indoor dust in residential apartments is a scenario of interest and is well characterized.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Raw data is not provided. Summary statistics are provided.
Metric 9:	Quality Assurance	High	QA/QC methods are provided.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Few limitations and gaps are provided. Variability is not characterized.

Overall Quality Determination   High

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:	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: Han, H., Park, B., Park, B., Ha, E. H., Hye Ah, L., Park, H., Young Sun, H. (2019). Associations of phthalate exposure with lipid levels and insulin sensitivity index in children: A prospective cohort study. Science of the Total Environment 662:714-721.

HERO ID: 5772241

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Medium. Most key criteria met. Duration of sample storage data lacking.
	Metric 2: Analytical Methodology	Medium	Medium. Most key criteria met, chemical-specific LOD's reported.
	Metric 3: Biomarker Selection	High	High. Sampling for metabolites specific for parent chemical of interest.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	High. Samples provided by participants in Seoul, South Korea.
	Metric 5: Currency	High	High. Samples collected 2005-2010 for participants at ages 3-5 follow-up, unspecified dates of sampling for additional follow-up urine specimen collection.
	Metric 6: Spatial and Temporal Variability	Low	Low. Urine specimens provided by a total of n=164 children at ages 3-5 years and 7-9 years, but for subjects with two or more follow-ups, data was only analyzed for that obtained at the youngest ages, non-statistical sampling methods.
	Metric 7: Exposure Scenario	Medium	Medium. Participant characteristics summarized, lack of information on pre-exposure or 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 procedures described with most key criteria met; lack of recovery data.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Medium. Variability characterized within summary statistics, minimal potential study limitations of residual confounding and potential storage container contamination reported.

Overall Quality Determination   Medium

| 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: | Lee, G., Kim, S., Kho, Y., Kim, S., Lee, S., Choi, G., Park, J., Worakhunpiset, S., Moon, H. B., Okanurak, K., Geounuppakul, M., Tangtitawong, J., Wetsutthanon, K., Trisurat, D., Choi, K. (2019). Urinary levels of phthalates and DINCH metabolites in Korean and Thai pregnant women across three trimesters. Science of the Total Environment 711:134822. |
| | HERO ID: | 5932874 |

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Most appropriate sampling methods for a biomonitoring study were included. Some sampling methods were not reported such as sampler calibration.
	Metric 2:	Analytical Methodology	Medium	The LOD was reported. Some analytical methods were not reported, such as recovery samples.
	Metric 3:	Biomarker Selection	High	The study reported an acceptable biomarker.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	This study was conducted in Korea and Thailand.
	Metric 5:	Currency	High	Samples were collected in 2016.
	Metric 6:	Spatial and Temporal Variability	High	There were >10 samples collected and replicates collected.
	Metric 7:	Exposure Scenario	Medium	The exposure source was not well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	High	Key QA was reported in this study.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some gaps and limitations were reported.

Overall Quality Determination   High

		Domain	Metric	Rating	Comments

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:	Fisher, M., Arbuckle, T. E., Macpherson, S., Braun, J. M., Feeley, M., Gaudreau, É. (2019). Phthalate and BPA exposure in women and newborns through personal care product use and food packaging. Environmental Science & Technology 53(18):10813-10826.		
HERO ID:	5932899		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Key criteria met, sample storage duration prior to analysis not reported, sampling methods detailed within text and referenced.
	Metric 2: Analytical Methodology	Medium	Most key criteria described, chemical-specific detection limits reported, analytic methods referenced, recovery data lacking.
	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 of P4 study at clinics within Ottawa, Canada.
	Metric 5: Currency	Medium	Enrollment during pregnancy prior to 20 weeks gestation 2009-2010.
	Metric 6: Spatial and Temporal Variability	Medium	Non-statistical sampling methods; multiple maternal spot urine samples (<= 10 samples) within one 24-hour weekday period, within one 24-hour weekend period, and a single spot urine specimen collected during second trimester (T2), T3 and 2-3 months post-partum for mothers; infant spot urines collected at delivery (n=45) and 2-3 months post-partum (n=55). Total number of maternal urines varied by chemical (n=513-1,260).
	Metric 7: Exposure Scenario	Medium	Participant characteristics summarized.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Most key criteria met; lack of raw data.
	Metric 9: Quality Assurance	High	Most key criteria met, analytic methods referenced; authors note potential for contamination with maternal MnBP and infant MnBP, MEHP, MEOHP samples, but not MIBP.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	High	Variability characterized within summary statistics, potential study limitations reported; authors note potential for contamination with maternal MnBP and infant MnBP, MEHP, MEOHP samples, but not MIBP.

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.
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:	Mercier, F., Gilles, E., Soulard, P., Mandin, C., Dassonville, C., Le Bot, B. (2020). On-line coupling of thermal extraction with gas chromatography / tandem mass spectrometry for the analysis of semivolatile organic compounds in a few milligrams of indoor dust. Journal of Chromatography A 1615:460768.		
HERO ID:	6393969		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Random subsample of 5 dust samples collected in French schools. The locations (within each school) of the dust samples are not reported.
Metric 2:	Analytical Methodology	High	LOD and LOQ reported. Results show that the new method performs as well as the conventional method for standard reference materials.
Metric 3:	Biomarker Selection	N/A	N/A since testing for parent chemical in an environmental medium.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	France
Metric 5:	Currency	Medium	2013 to 2017
Metric 6:	Spatial and Temporal Variability	Medium	5 samples. Replicate samples were used to compare the two methods. Replicates were also used for the 5 school dust samples.
Metric 7:	Exposure Scenario	High	School data is from a large school survey.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	High	SI lists summary statistics for the 5 replicates of all 5 samples.
Metric 9:	Quality Assurance	High	Thorough QA/QC discussion.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Good discussion of uncertainties/variability in main paper.

Overall Quality Determination   **High**

Study Citation:	Chen, J., Shi, X., Zhou, X., Dong, R., Yuan, Y., Wu, M., Chen, W., Liu, X., Jia, F., Li, S., Yang, Q., Chen, B. (2020). Renal function and the exposure to melamine and phthalates in Shanghai adults. Chemosphere 246:125820.		
HERO ID:	6813754		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Limited description of sampling methodology.
	Metric 2: Analytical Methodology	High	Detailed analytical methods, reported LOD.
	Metric 3: Biomarker Selection	High	Biomarker is known to be related to external exposure.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Shanghai, China
	Metric 5: Currency	Medium	Samples from 2012.
	Metric 6: Spatial and Temporal Variability	Low	n = 1663, no replicates.
	Metric 7: Exposure Scenario	High	Data closely represent relevant exposure scenarios.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Low	Concentration data was not provided in manuscript or in SI.
	Metric 9: Quality Assurance	High	Described QA/QC techniques, analyzed control samples.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Variability was not characterized, uncertainties and limitations were discussed.

Overall Quality Determination   Medium

Study Citation:	Chin, H. B., Jukic, A. M., Wilcox, A. J., Weinberg, C. R., Ferguson, K. K., Calafat, A. M., Mcconnaughey, D. R., Baird, D. D. (2019). Association of urinary concentrations of early pregnancy phthalate metabolites and bisphenol A with length of gestation. Environmental Health 18(1):80.		
HERO ID:	6813785		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	All pertinent sampling methods were described. This paper continued the North Carolina Early Pregnancy Study (EPS), a prospective cohort study. In the early 1980s, daily first-morning urine samples were collected in polypropylene jars, and women were monitored for pregnancy for EPS. In this study, during 2010-2011, women were re-contacted to determine outcome of pregnancy. Those available had urine tested for phthalate metabolites. Investigators pooled three pre-conception and three post-conception urine samples for each woman.
	Metric 2:	Analytical Methodology	Low	U.S. CDC analyzed urine samples using SPE isotope dilution HPLC-MS/MS, as described in Silva et al. (2007), HERO 807138. Possible effects of long-term frozen storage on phthalate metabolite concentrations evaluated by Baird et al. (2010), HERO 673435. LODs/LOQs were not reported.
	Metric 3:	Biomarker Selection	High	MiBP is a specific metabolite of DiBP. All concentrations were standardized to creatinine mass measured in pooled urine samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was conducted in North Carolina.
	Metric 5:	Currency	Low	Urine samples collected in 1982 through 1986 and analyzed after 2007. Thus, samples were frozen for at least two decades before analysis.
	Metric 6:	Spatial and Temporal Variability	Medium	First morning urine samples were collected daily. Three preconception samples from the same woman were pooled to minimize episodic spikes in phthalate metabolites in urine (n=125 women). Similarly, three post-conception samples were pooled for each woman (n=121). Primarily Monday samples, collected one week apart, were pooled.
	Metric 7:	Exposure Scenario	Medium	No exposure scenarios were specified because exposure is presumed to be widespread.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1 presented median and IQR for metabolite concentrations and the same statistics for the molar sum of all four DEHP metabolites. Raw data were not provided.
	Metric 9:	Quality Assurance	Low	No explicit discussion of QA/QC techniques, but can be implied through its use of CDC laboratory for analysis. QA/QC was also discussed in HERO 673435, although MECPP was not included in that report.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variance was characterized with IQR in Table 1. Limitations were described in Discussion. HERO 673435 described variation in metabolite concentrations among first morning urine samples within and between women and over time; it also compared variation in first morning urine to spot samples from other studies.

Overall Quality Determination   Medium

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

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

Overall Quality Determination   High

Study Citation:	Urbancova, K., Lankova, D., Sram, R. J., Hajslova, J., Pulkrabova, J. (2019). Urinary metabolites of phthalates and di-iso-nonyl cyclohexane-1,2-dicarboxylate (DINCH)-Czech mothers' and newborns' exposure biomarkers. Environmental Research 173:342-348.		
HERO ID:	6814511		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Key sampling methods reported. Sampling methods, equipment, storage described.
	Metric 2: Analytical Methodology	High	Key analytical methods reported. Extraction methods, analytical instrument, LOQ reported, calibration standards used.
	Metric 3: Biomarker Selection	High	Metabolite is derived from parent chemical (MiBP).
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Czech Republic
	Metric 5: Currency	Medium	Samples collected in 2013 and 2014
	Metric 6: Spatial and Temporal Variability	Medium	204 samples. No replicates.
	Metric 7: Exposure Scenario	High	Measuring metabolites in pregnant women and newborns.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Raw data not reported. Mean, median, min and max reported.
	Metric 9: Quality Assurance	High	Key QA reported. Recoveries of 70–126%. A procedural blank sample, which contained deionised water instead of urine, was prepared with each set of samples.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	No limitations discussed. Comparison of results with other studies.

Overall Quality Determination   High

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:	Huang, P. C., Chang, W. H., Wu, M. T., Chen, M. L., Wang, I. J., Shih, S. F., Hsiung, C. A., Liao, K. W. (2020). Characterization of phthalate exposure in relation to serum thyroid and growth hormones, and estimated daily intake levels in children exposed to phthalate-tainted products: A longitudinal cohort study. Environmental Pollution 264:114648.		
HERO ID:	6815852		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	While urine sample collection is relatively straightforward, the study's description of sampling methods is still limited.
Metric 2:	Analytical Methodology	Medium	The analytical protocol mostly referenced previously published methods and did not include general information on key information (e.g., extraction).
Metric 3:	Biomarker Selection	High	MiBP is specific to DiBP.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Study was performed in Taiwan.
Metric 5:	Currency	High	Sampling began in 2012 and lasted through 2016.
Metric 6:	Spatial and Temporal Variability	Low	Researchers recruited 166 children to participate. Spot urine samples - presumably unpooled - were collected.
Metric 7:	Exposure Scenario	High	This is a biomonitoring study were exposure has presumably occurred during the 2011 food scandal.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Only summary statistics and no raw data were provided.
Metric 9:	Quality Assurance	Low	QA/QC techniques were not discussed but can be implied through the study's use of previously published protocols.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Variance was characterized and uncertainties and limitations were discussed.

Overall Quality Determination   Medium

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

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

Overall Quality Determination High

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

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

Overall Quality Determination   **Medium**

Study Citation:			SUNY, (2019). Semi-volatile organic compounds in infant homes: Levels, influence factors, partitioning, and implications for human exposure. Environmental Pollution 251:609-618.
HERO ID:			6815979

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology were provided and described, including sampling procedure, equipment, storage, and matrix characteristics.
	Metric 2:	Analytical Methodology	High	Analytical methodology was provided and briefly described. Samples were Soxhlet extracted and analyzed using GC-MS.
	Metric 3:	Biomarker Selection	N/A	The analyte measured is the TSCA chemical.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The samples were collected in China.
	Metric 5:	Currency	Medium	Data were collected from December 2013 to March 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	25 air samples, 25 dust samples, and 18 window filmsamples were collected. No replicate data were collected.
	Metric 7:	Exposure Scenario	High	The samples were collected in indoor environment, which represent the exposure of anyone who comes into contact with these home environment.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported. Summary statistics including median, mean, and standard deviation were reported.
	Metric 9:	Quality Assurance	High	Analytical QA/QC were reported. The recoveries in this study ranged from 64.1% to 132%. All the SVOC concentrations in real samples were corrected with blanks and recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Some sources of variability and uncertainty were discussed and significance values were reported (p values).

Overall Quality Determination   High

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

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

Overall Quality Determination   **Medium**

| | Study Citation: | Li, X. H., Ma, L. L., Liu, X. F., Fu, S., Cheng, H. X., Xu, X. B. (2006). Phthalate ester pollution in urban soil of Beijing, People's Republic of China. Bulletin of Environmental Contamination and Toxicology 77(2):252-259. |
| | HERO ID: | 6816020 |

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods reported- including equipment, procedures, and storage.
	Metric 2:	Analytical Methodology	Medium	Key analytical methods reported for extraction and analysis (centrifugation and GC). Recoveries reported. LOD reported as a range and equipment calibration not reported.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Beijing, China
	Metric 5:	Currency	Low	Sampling date not reported. Study published in 2006.
	Metric 6:	Spatial and Temporal Variability	Medium	At least 30 samples. No replicates
	Metric 7:	Exposure Scenario	Medium	Exposure source not well characterized- soil in urban and rural area.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported. Summary statistics provided (min, max, range, mean).
	Metric 9:	Quality Assurance	High	QA criteria reported, such as recoveries and matrix blanks reported as ranges.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	The study mentions that there is a lack of environmental quality standard for soil about PAEs in China. SD reported and spatial variation analyzed.

Overall Quality Determination   Medium

Study Citation:	Maceira, A., Pecikoza, I., Marcé, R. M., Borrull, F. (2020). Multi-residue analysis of several high-production-volume chemicals present in the particulate matter from outdoor air. A preliminary human exposure estimation. Chemosphere 252:126514.
HERO ID:	6816026

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling sites are adequately described.
	Metric 2:	Analytical Methodology	High	QFF filters are adequately described.
	Metric 3:	Biomarker Selection	N/A	Not applicable for parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Catalonia, Spain.
	Metric 5:	Currency	High	Samples were collected from September 2018 - February 2019.
	Metric 6:	Spatial and Temporal Variability	High	12 samples were collected at each sampling point (PM10).
	Metric 7:	Exposure Scenario	High	Samples collected at two sites influenced by different industrialactivities.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary stats reported, raw data not reported.
	Metric 9:	Quality Assurance	High	QA reported on blanks, standard controls, and repeatability.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Repeatability and reproducibility (inter day and intra day precision) was reported (RSD <11%).

Overall Quality Determination   High

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

Overall Quality Determination   High

Domain		Metric	Rating	Comments
Study Citation:		Paluselli, A., Kim, S. K. (2020). Horizontal and vertical distribution of phthalates acid ester (PAEs) in seawater and sediment of East China Sea and Korean South Sea: Traces of plastic debris?. Marine Pollution Bulletin 151:110831.		
HERO ID:		6816206		
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	sampling horizontal and vertically in water column and sediments in the area; sampling location (Fig 1 and p.3); water collected in Niskin bottles; duplicates at each water depth; stored at 4C; sediment collected via grab sampler, stored in glass bottles at -20C and freeze dried, ground, and sieved
	Metric 2:	Analytical Methodology	High	SPE (seawater) and ultrasonic bath (sediments); GC/MS; recoveries; LOQ provided in Table S1
	Metric 3:	Biomarker Selection	N/A	Environmental media
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Northwest Pacific marginal seas (South China Sea, East Sea/Sea of Japan, Yellow Sea, and the East China Sea)
	Metric 5:	Currency	High	2018
	Metric 6:	Spatial and Temporal Variability	High	88 seawater samples from 8 stations in September; sediment collected from each station (8 samples total). Duplicate water samples collected at each water depth
	Metric 7:	Exposure Scenario	High	seawater at different water depths and sediment from northwest Pacific marginal sea
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1 provides the concentration in sediment from the three main water masses (mean and range per each sector); Raw data not provided
	Metric 9:	Quality Assurance	High	recoveries in seawater and sediments provided Table S1; blanks
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	compared results in water and sediment by area and recent studies

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:	Wu, H., Kupsco, A. J., Deierlein, A. L., Just, A. C., Calafat, A. M., Oken, E., Braun, J. M., Mercado-Garcia, A., Cantoral, A., Téllez-Rojo, M. M., Wright, R. O., Baccarelli, A. A. (2020). Trends and patterns of phthalates and phthalate alternatives exposure in pregnant women from Mexico City during 2007-2010. Environmental Science & Technology 54(3):1740-1749.		
HERO ID:	6817118		

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) are absent that are unlikely to have a substantial impact on results.
Metric 2:	Analytical Methodology	Low	Analytical instrumentation and methods (high-performance liquid chromatography coupled with tandem MS) are only briefly described but are referenced to a previous publication. LOD is only provided as a range for all analytes.
Metric 3:	Biomarker Selection	High	Metabolites of phthalates were measured in urine. The metabolite of this chemical measured was unique to it.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Mexico
Metric 5:	Currency	Medium	Samples were from 2007-2011.
Metric 6:	Spatial and Temporal Variability	Medium	Pooled urine spot samples from 948 participants in the second trimester of pregnancy and samples from 792 of the same participants in the third trimester. No replicates were collected from the same population at the same point in time.
Metric 7:	Exposure Scenario	High	Exposure scenario is relevant for pregnant women and fetuses during gestation.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Raw data are not reported in the paper or SI. Summary statistics reported include detection rate and percentiles (25, 50, 75, 90) of the metabolite concentrations measured.
Metric 9:	Quality Assurance	Medium	QA is not discussed much. There is a passing reference to "standard analytical QC protocols of the CDC laboratory." Additionally, a random sample collected outside the study design was analyzed 92 times as a blinded replicate sample.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	There is no discussion of uncertainty. Some information about variability can be gleaned from reporting the 25th/50th/75th/90th percentile measurements. There is some discussion of limitations.

Overall Quality Determination   Medium

Study Citation:	SUNY, (2020). Phthalate exposure in Chinese homes and its association with household consumer products. Science of the Total Environment 719:136965.		
HERO ID:	6817545		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Sample matrix/characteristics, equipment, regimen, storage, and more were well described.
	Metric 2: Analytical Methodology	High	Extraction, analytical instruments, LODs/LOQs, recoveries and more were well described.
	Metric 3: Biomarker Selection	N/A	Study measured parent chemicals in indoor dust.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Samples were collected from homes in Tianjin and Cangzhou, China.
	Metric 5: Currency	Medium	Data collected between Sept 2013 and Jan 2016.
	Metric 6: Spatial and Temporal Variability	Medium	Dust was collected from 399 homes without replicates.
	Metric 7: Exposure Scenario	High	Phthalate exposure via indoor dust from household products is relevant.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	No raw data were provided.
	Metric 9: Quality Assurance	High	QA/QC described, including blanks, spiked samples, and recoveries (all acceptable).
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Low	No information was provided on gaps and limitations.

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:	Agarwal, R., Shukla, K., Kumar, S., Aggarwal, S. G., Kawamura, K. (2020). Chemical composition of waste burning organic aerosols at landfill and urban sites in Delhi. Atmospheric Pollution Research 11(3):554-565.		
HERO ID:	6824497		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Calibration of sampler is missing
	Metric 2:	Analytical Methodology	Medium	Detection limits are not reported
	Metric 3:	Biomarker Selection	N/A	Chemical is measured in outdoor air
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Delhi, India
	Metric 5:	Currency	Medium	December 2011 and October 2014 (see 2.1 Sampling)
	Metric 6:	Spatial and Temporal Variability	Medium	No replicate samples
	Metric 7:	Exposure Scenario	High	"Total suspended particles collected from an open waste burning landfill site and an urban site of Delhi, one of the most populated cities of Asia was studied."
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual data points are not reported.
	Metric 9:	Quality Assurance	Medium	Brief mention of quality assurance in Section 2.2. Chemical analyses "Field blank filters were treated the similar way for quality assurance."
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Minimum and maximum concentrations are reported in Table 2. Limited discussion of key uncertainties.

Overall Quality Determination   Medium

Study Citation:	Chuang, S. C., Chen, H. C., Sun, C. W., Chen, Y. A., Wang, Y. H., Chiang, C. J., Chen, C. C., Wang, S. L., Chen, C. J., Hsiung, C. A. (2020). Phthalate exposure and prostate cancer in a population-based nested case-control study. Environmental Research 181:108902.
HERO ID:	6826333

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Certain details of sample collection (e.g. collection procedures) are missing that could have a substantial impact on results (but may have been reported elsewhere where the cohort was first described). The spot urine samples were frozen at -30 C for over 20 years before analysis. The discussion mentions that the samples were stored in plastic vials.
	Metric 2:	Analytical Methodology	Medium	Analytical instrumentation and methods are described in sufficient detail. LODs are reported. Blanks were used, but certain aspects (e.g., recovery samples and instrument calibration) are not discussed, but are not likely to have a substantial impact on results.
	Metric 3:	Biomarker Selection	High	The monoester phthalate biomarker measured is a metabolite of only this parent chemical.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Taiwan
	Metric 5:	Currency	Low	1991-1992
	Metric 6:	Spatial and Temporal Variability	Low	Spot urine samples from 236 participants. I do not see evidence of the samples having been pooled, so I rated this as low.
	Metric 7:	Exposure Scenario	Medium	A "lifestyle questionnaire" was administered to participants who gave urine samples, which would reflect the totality of their exposures to phthalates. Data were not broken down based on different characteristics, such as whether the participant smoked.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual data points are not reported; summary statistics include the detection rate, geometric mean, and percentiles (5, 25, 50, 75, 95) of concentration. Samples were broken out by whether the participant was or was not later diagnosed with prostate cancer.
	Metric 9:	Quality Assurance	Medium	Measurements were performed at a laboratory which conducts annual external quality assurance following accepted protocols. Additionally, inter- and intra-batch coefficients of variance are reported and were less than or equal to 27%. Blanks were also sampled in each batch. No other discussion of particular QA measures was included.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Coefficients of variation were reported for each metabolite batch, but there was little other information on variability. There was discussion of various limitations/sources of uncertainty. Plastic vials were used for sample collection, but samples were frozen right away, and the authors thought "there should be minimum interaction between the plastic vials and the biological content."

Overall Quality Determination   Medium

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: | Zhang, J., Yin, W., Li, P., Hu, C., Wang, L., Li, T., Gao, E., Hou, J., Wang, G., Wang, X., Wang, L., Yu, Z., Yuan, J. (2019). Interaction between diet- and exercise-lifestyle and phthalates exposure on sex hormone levels. Journal of Hazardous Materials 369:290-298. |
| **HERO ID:** | 6957457 |

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Some information missing such as what was urine stored in and blood sampling methods.
	Metric 2: Analytical Methodology	Medium	Limited description of analytical methods, only equipment reported. LOD for each metabolite detailed.
	Metric 3: Biomarker Selection	High	Biomarker is known to represent exposure to parent chemical. Metabolites are derived from parent chemical (MiBP).
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	China
	Metric 5: Currency	High	Sampling began in 2014, finished in 2015
	Metric 6: Spatial and Temporal Variability	Low	106 study participants, 3 replicates. Spot sampling for urine.
	Metric 7: Exposure Scenario	Medium	Characterized the population but not their relation to the source of exposure.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Results are shown as averages in seasons and odds ratios.
	Metric 9: Quality Assurance	Medium	Limited QA/QC discussed. The recovery of the method ranged from 74.6% and 104.8%. Urinary levels of nine phthalate metabolites were corrected with the corresponding urinary creatinine concentrations.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	Variability in seasons measured. Limitations not discussed.

Overall Quality Determination   **Medium**

Study Citation: Tang, S., He, C., Thai, P., Vijayasarathy, 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:	England-Mason, G., Grohs, M. N., Reynolds, J. E., Macdonald, A., Kinniburgh, D., Liu, J., Martin, J. W., Lebel, C., Dewey, D. (2020). White matter microstructure mediates the association between prenatal exposure to phthalates and behavior problems in preschool children. Environmental Research 182:109093.		
HERO ID:	6958936		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Sampling methods are described in moderate detail, but certain aspects (e.g. duration of storage, time of day of collection) were not reported; these are unlikely to have a substantial impact on results.
Metric 2:	Analytical Methodology	Medium	Analytical instrumentation and methods were described in detail, and the LODs were reported. It's unclear if it is standard practice to operate the so-called QTRAP equipment in "negative multiple reaction monitoring (MRM) mode, [with] the detection and quantification of metabolites [being] based on two MRM transitions combined with the retention time." Assigned it medium since neither calibration nor recoveries were reported.
Metric 3:	Biomarker Selection	High	Metabolites of parent chemicals were measured in urine. The metabolites of this chemical were unique to it.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Canada
Metric 5:	Currency	Medium	Maternal urine samples were taken during pregnancy from mothers of children who were ages 3-5 from 2013-2017; therefore, urine samples were collected sometime between 2008-2014 (not otherwise specified). It should be noted that the study also collected information about the white matter microstructure in children's brains and childhood behavior problems, reporting on potential association between these characteristics and phthalate exposure as a fetus.
Metric 6:	Spatial and Temporal Variability	Low	One spot urine sample was collected per participant (76), without the use of replicates. Rated low because it appears each was an unpooled spot sample.
Metric 7:	Exposure Scenario	Medium	Urinary metabolites are likely a good indicator of relative exposure of fetuses to maternal blood during gestation. A detailed questionnaire with information about potential sources of exposure to phthalates was not used, but these chemicals are ubiquitous.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Individual data points are not reported; summary statistics include the percentage of samples above LOD, minimum, maximum, percentiles (25th, 50th, 75), and the median molar concentration.
Metric 9:	Quality Assurance	Medium	QC "experiments using liquid chromatography grade water as a surrogate for urine (n = 20 control samples) did not find any contamination during collection, storage, and/or analysis." No other QA/QC techniques and results (e.g., recoveries) were directly discussed, but others may have been used given the study's use of standard field and laboratory protocols.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	The only information on variability is embedded in the data on percentiles. There was some discussion of limitations (e.g., the small sample size) and sources of uncertainty, most of them related to the study of white matter microstructure and reporting of child behavior.

Overall Quality Determination   Medium

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

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

HERO ID: 6958938

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:	Zhao, X., Jin, H., Ji, Z., Li, D., Kaw, H. Y., Chen, J., Xie, Z., Zhang, T. (2020). PAES and PAHs in the surface sediments of the East China Sea: Occurrence, distribution and influence factors. Science of the Total Environment 703:134763.		
HERO ID:	6959327		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Site characteristics/matrix were reported in detail, but missing information on sample equipment, storage condition, etc.
Metric 2:	Analytical Methodology	High	Key analytical methods were reported in both the main paper and supplemental, with the latter offering a lot of details.
Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in sediment.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Study was conducted in China.
Metric 5:	Currency	High	Samples were collected in 2017.
Metric 6:	Spatial and Temporal Variability	Medium	29 samples were collected without any reporting of replicates.
Metric 7:	Exposure Scenario	High	Exposure source was characterized.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Raw data were provided in Table S3, but most summary statistics were missing.
Metric 9:	Quality Assurance	Medium	QA/QC was reported. Recoveries reported as a range for all phthalates combined (59.8-104.8). That was no reporting of how the low recoveries were corrected.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	Variance characterized by range, but key gaps and limitations were not reported.

Overall Quality Determination   High

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

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

Overall Quality Determination — **High**

Study Citation:	Schmidt, N., Castro-Jimenez, J., Fauvelle, V., Ourgaud, M., Sempere, R. (2020). Occurrence of organic plastic additives in surface waters of the Rhone River (France). Environmental Pollution 257:113637.		
HERO ID:	6966453		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Sampling methodology was well described, including sampling procedure, sampling storage, study site characteristics.
	Metric 2: Analytical Methodology	Medium	Analytical methodologies were well described. LOQ range was reported in paper, all LODs and LOQs may be reported in SI.
	Metric 3: Biomarker Selection	N/A	The analyte was measured in environmental media.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Samples were collected from the Rhone River, France.
	Metric 5: Currency	High	Samples were collected from May 2017 to April 2018.
	Metric 6: Spatial and Temporal Variability	High	Samples were collected in duplicate over the course of a year.
	Metric 7: Exposure Scenario	High	Site and potential sources were well characterized. Data represented exposure to anyone who comes into contact with these rivers.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Raw data were not reported. Several summary statistics were reported, including min, max, median, mean, and standard deviation.
	Metric 9: Quality Assurance	High	The study applied quality assurance measures and no issues were identified. Recovery rates were reported for individual analytes.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	High	The study characterized variability, fluxes, and other sources to the Rhone River. The study described other potential sources that might result in underestimation of the concentrations of analytes in the river.

Overall Quality Determination   High

Study Citation:		Ma, L. L., Chu, S. G., Xu, X. B. (2003). Phthalate residues in greenhouse soil from Beijing suburbs, People's Republic of China. Bulletin of Environmental Contamination and Toxicology 71(2):394-399.		
HERO ID:		6967234		

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	LOD reported as a range not for individual chemicals.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Beijing, China
	Metric 5:	Currency	Low	Samples collected in 2001
	Metric 6:	Spatial and Temporal Variability	Medium	5-10 samples; no replicates
	Metric 7:	Exposure Scenario	Medium	Exposure sources not well characterized
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	raw data reported- no summary statistics.
	Metric 9:	Quality Assurance	Medium	QA not directly reported- standards and recoveries reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No discussion of variation or limitations.

Overall Quality Determination   Medium

Study Citation:	Qian, X.,i, Li, J., Xu, S., Wan, Y., Li, Y., Jiang, Y., Zhao, H., Zhou, Y., Liao, J., Liu, H., Sun, X., Liu, W., Peng, Y., Hu, C., Zhang, B.,in, Lu, S.,hi, Cai, Z., Xia, W.,ei (2019). Prenatal exposure to phthalates and neurocognitive development in children at two years of age. Environment International 131:105023.		
HERO ID:	6967437		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	Medium	Sampling methodology is adequately described and generally appropriate. Discussion does not include every detail, e.g. duration of sample storage, but this is unlikely to have a substantial impact on results.
	Metric 2: Analytical Methodology	Medium	Analytical methodology is detailed in a separate reference, and limits of detection are provided in supplemental materials.
	Metric 3: Biomarker Selection	Low	MBP is specific to DBP.
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Samples were collected in Hubei Province, China.
	Metric 5: Currency	Medium	Samples were collected in 2014-2015.
	Metric 6: Spatial and Temporal Variability	Medium	Urine spot samples were collected at multiple timepoints throughout pregnancy
	Metric 7: Exposure Scenario	Medium	Study population is likely representative of mother-child pairs. This is a biomonitoring study were children are exposed in-utero and mothers are exposed due to widespread use of phthalates.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Individual data points were not reported.
	Metric 9: Quality Assurance	High	QC measures included analysis of blanks and QC samples alongside batch samples. Within-batch and between-batch coefficients of variation were 9.9% and 13.7%, respectively. Specific gravity was accounted for.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	There was a limited characterization of variance and a brief discussion of study limitations, including the use of averaging across urine spots instead of a measurement error model.

Overall Quality Determination   **Medium**

Study Citation:	Bartsch, P. W., Edwards, T. M., Brock, J. W. (2019). Prevalence of eight phthalate monoestersin water from the Okavango Delta, Northern Botswana. Bulletin of Environmental Contamination and Toxicology 103(2):274-279.		
HERO ID:	6968214		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Key methods reported. Site characteristics, sampling equipment, method, and storage described. More information referenced in (Blount 2000; Silva 2010).
Metric 2:	Analytical Methodology	High	Key analytical methods reported. Methods, equipment (LCMS-8040 and HPLC column), calibration, and LOD reported.
Metric 3:	Biomarker Selection	Medium	Metabolites measured in water samples. It is not mentioned that these biomarkers are derived from the parent chemical of interest.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Botswana
Metric 5:	Currency	High	Samples collected in 2016
Metric 6:	Spatial and Temporal Variability	Medium	46 samples no replicates
Metric 7:	Exposure Scenario	High	Samples taken from The Okavango Delta, where there is wildlife and human activity that can be exposed.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Raw data not reported. Average, range, and highest levels reported for each metabolite.
Metric 9:	Quality Assurance	Medium	Little QA discussion but there were sample controls and recovery. Concentrations were corrected for original sample volumefrom field records.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Variability in different sites reported and comparison of concentrations to other bodies of water. SD was mentioned to be calculated but not reported in study. Few gaps and limitations reported.

Overall Quality Determination   High

Study Citation:	Shin, H., Moschet, C., Young, T. M., Bennett, D. H. (2019). Measured concentrations of consumer product chemicals in California house dust: Implications for sources, exposure, and toxicity potential. Indoor Air 30(1):60-75.
HERO ID:	6968217

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Method for recruiting the 38 households not explained.
	Metric 2:	Analytical Methodology	High	Standard LC and GC protocols were described and LODs were reported.
	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 Northern California.
	Metric 5:	Currency	High	Samples were collected in 2015-2016.
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates were reported among 38 samples.
	Metric 7:	Exposure Scenario	Medium	Limited information on chemical use.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported. Summary statistics were reported.
	Metric 9:	Quality Assurance	Low	No discussion of QA/QC although standard protocols were used. No discussion of recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some uncertainties and limitations are discussed in the section entitled "Overview and scope of this study".

Overall Quality Determination   Medium

Study Citation:	Wang, R., Ji, M., Zhai, H., Liu, Y. (2020). Occurrence of phthalate esters and microplastics in urban secondary effluents, receiving water bodies and reclaimed water treatment processes. Science of the Total Environment 737:140219.		
HERO ID:	6968279		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Sampling methodology is explained in detail.
Metric 2:	Analytical Methodology	High	Analytical methods reported in detail in both main text and supplemental. Detection limits provided in Table S1.
Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals from waste water treatment plants.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Study was performed in China.
Metric 5:	Currency	High	Samples collected in 2017 and 2018
Metric 6:	Spatial and Temporal Variability	Medium	Replicates were not reported.
Metric 7:	Exposure Scenario	High	Possible exposure to phthalates from wastewater treatment plant effluents is relevant.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Low	No raw data were reported. Table S6 only provides physiochemical properties of water samples and not the concentrations of analytes themselves. Data presented visually with some ranges provided in Results text.
Metric 9:	Quality Assurance	Low	Limited, if any, QA/QC methods were reported.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	Gaps and limitations were not reported. Variance reported with a range in text.

Overall Quality Determination   Medium

Study Citation:	Feng, Y. L., Liao, X. J., Chen, D., Takser, L., Cakmak, S., Chan, P., Zhu, J. P. (2020). Correlations of phthalate metabolites in urine samples from fertile and infertile men: Free-form concentration vs. conjugated-form concentration. Environmental Pollution 263(Pt. A):114602.		
HERO ID:	6968351		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Demographics of participants, storage, and collection procedures were explained but missing some information on duration of storage and collection equipment.
Metric 2:	Analytical Methodology	High	Detailed analytical methods with LOD reported in supplementary information.
Metric 3:	Biomarker Selection	High	MiBP is specific to DiBP.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Study conducted in Canada.
Metric 5:	Currency	Medium	Sampling was conducted in 2009-2012.
Metric 6:	Spatial and Temporal Variability	Low	A single urine sample was collected from each of 150 participants without replicates.
Metric 7:	Exposure Scenario	High	This is a biomonitoring study were exposure was presumed to occur through phthalates' ubiquity in consumer products.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Only summary statistics were reported (i.e., no raw data).
Metric 9:	Quality Assurance	High	QA/QC techniques were reported in detail.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Variance was characterized with percentiles, and some limitations were reported in the conclusions.

Overall Quality Determination   High

Study Citation: Yue, N., Deng, C., Li, C., Wang, Q.,i, 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 thesix 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:	Sugeng, E. J., Symeonides, C., O'Hely, M., Vuillermin, P., Sly, P. D., Vijayasarathy, P., Thompson, N. K., Pezic, A., Mueller, M., Ponsonby, A. (2020). Predictors with regard to ingestion, inhalation and dermal absorption of estimated phthalate daily intakes in pregnant women: The Barwon infant study. Environment International 139:105700.		
HERO ID:	6968855		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Low	Sample collection is only briefly discussed, and missing details may substantially impact the results. These details are also missing from the cited reference.
Metric 2:	Analytical Methodology	High	Analytical instrumentation and methods are based on multiple cited references and described in sufficient detail. 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	Australia
Metric 5:	Currency	Medium	2010-2013
Metric 6:	Spatial and Temporal Variability	Medium	Pooled spot urine samples from 841 pregnant women
Metric 7:	Exposure Scenario	High	The exposure scenario to fetuses during gestation is highly relevant.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Medium	Raw data are not reported; summary statistics include percentage above LOD, geometric mean, minimum, maximum, and percentiles (25, 50, 75) of concentration
Metric 9:	Quality Assurance	Medium	QA/QC techniques included use of replicates and blanks; no other techniques were directly discussed, but can be implied through the study's use of standard field and laboratory protocols.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	No measure of variability was reported, but there is robust discussion of limitations/sources of uncertainty.

Overall Quality Determination   Medium

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 anaytical 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:	U.S. EPA, (1977). Evaluation and wastewater characterization: Northeast Philadelphia water pollution control plant, Philadelphia, Pennsylvania (September 16-23, 1976).		
HERO ID:	6985025		

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., procedures approved by EPA for monitoring of industrial effluents). See Page 11, Appendix E - Analytical Procedures and Quality Control, and Appendix F - Organics Analytical Methodology.
	Metric 2: Analytical Methodology	Medium	Analytical methodology is discussed in detail (Appendices E, F, and G) and is clear and appropriate (i.e., scientifically sound) for the chemical and media of interest; however, one or more pieces of analytical information is not described (LOQ, LOD, detection limits, and/or reporting limits not provided). The missing information is unlikely to have a substantial impact on results.
	Metric 3: Biomarker Selection	N/A	The study is testing in an environmental media (water).
Domain 2: Representativeness			
	Metric 4: Geographic Area	High	Geographic location is reported; Northeast Philadelphia
	Metric 5: Currency	Low	Timing of sample collection for monitoring data is not consistent with when current exposures (September 1976; >15 years old) may be expected and likely to have a substantial impact on results.
	Metric 6: Spatial and Temporal Variability	High	Sampling approach accurately captures variability of environmental contamination in population/scenario/media of interest. The study used a large sample size; >10 samples were collected as part of a compliance program and replicates were collected.
	Metric 7: Exposure Scenario	High	The exposure scenario is relevant (Influent and effluent of wastewater treatment plant). Microenvironment data (location, time, climate) provided.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	Medium	Supplementary or raw data (i.e., individual data points) are not reported, and therefore summary statistics cannot be reproduced.
	Metric 9: Quality Assurance	Low	Quality assurance/quality control techniques and results were not directly discussed, but can be implied through the study's use of standard field and laboratory protocols.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Medium	The report had limited discussion on the characterization of variability and uncertainty.

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

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

Overall Quality Determination   Medium

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

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

Overall Quality Determination   Medium

Study Citation:	Billings, A., Carter, H., Cross, R. K., Jones, K. C., Pereira, M. G., Spurgeon, D. J. (2023). Co-occurrence of macroplastics, microplastics, and legacy and emerging plasticisers in UK soils. Science of the Total Environment 880:163258.		
HERO ID:	11785155		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Sampling methodology for soil and plastic item collection was thoroughly described including sampling equipment, procedures, storage conditions, study site characteristics, and matrix characteristics.
Metric 2:	Analytical Methodology	High	Analytical methodology was described in detail, including the soil digestion method, instrument calibration, analytical instrumentation, recovery samples, and limits of detection. Limits of detection are reported in Table 1 and Table S4.
Metric 3:	Biomarker Selection	N/A	The parent chemical was measured in environmental soil samples.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Samples were collected in central and southern England (UK).
Metric 5:	Currency	High	Sampling took place in January and February of 2020.
Metric 6:	Spatial and Temporal Variability	Medium	There were 3-7 samples for each different land use scenario, multiple samples were taken at each site and combined to account for spatial variation across the site. Samples were only collected one time
Metric 7:	Exposure Scenario	Medium	Exposure to humans was not explicitly discussed. However, this is an environmental monitoring study where exposure to phthalates can occur through contaminated soil. Information regarding the microenvironment was provided. There was a use of exposure controls, using woodland soils that were expected to have minimal phthalate concentrations.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	High	Results are reported in Table 2. Summary statistics are detailed and complete including mean, median, range, and detection frequency.
Metric 9:	Quality Assurance	High	Quality assurance and quality control were described in detail including recoveries, blanks, positive controls, and microplastic control measures.
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	High	Limitations and uncertainties are discussed in detail in section 3.3. Additionally, they discuss the limitation of a relatively small number of sampling sites. Variability was characterized using the range in Table 2. They also statistically examined the variation of different contaminants between land uses.

Overall Quality Determination   High

Study Citation:	Uhde, E., Bednarek, M., Fuhrmann, F., Salthammer, T. (2001). Phthalic esters in the indoor environment–test chamber studies on PVC-coated wallcoverings. Indoor Air 11(3):150-155.		
HERO ID:	789761		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	High	Sampling equipment, testing conditions and procedures were clearly defined. Methods were cited.
	Metric 2:	Analytical Methodology	Low	Detection limits were not provided for study, study did mention detection limits used in other cited studies. Analytical method was described. GC/MS used for chamber air samples. CIS/GC-MS used for analyzing fogging plates. Missing calibration for instrument.
	Metric 3:	Biomarker Selection	N/A	No biomarkers used in this study.
Domain 2: Representative				
	Metric 4:	Testing Scenario	Medium	Samples of PVC-coated wall coverings were initially screened and then the samples with representative high, medium, and low detections were used in the chamber study. Scenario parameters included temperature, RH, AER, and loading).
	Metric 5:	Sample Size and Variability	Low	Study did not mention replicate samples. Six samples were tested over 14 days in the chamber. Samples results were reported as air concentrations (chamber) and mass collected (fogging plates).
	Metric 6:	Temporality	Low	Study was published in 2001 (>15 years ago).
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	Maximum air concentration data provided for DBP for each chamber test and Time vs Concentration was plotted. Total mass accumulated for DBP was reported for fogging plate results. Some raw and supplemental data were provided.
	Metric 8:	Quality Assurance	Low	Study provided chamber blank results but did not discuss QA/QC measures taken. Can only assume additional measures were taken since they reportedly followed published methods.
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Medium	The study started the screening process with 14 different wall coverings (these were narrowed down to six for the chamber test). Limitations and uncertainties were minimally discussed.

Overall Quality Determination   **Low**

| | Study Citation: | Fierens, T., Vanermen, G., Van Holderbeke, M., De Henauw, 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 Conditions	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 performed 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 products 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: Llompart, M., Sanchez-Prado, L., Pablo Lamas, J., Garcia-Jares, C., Roca, E., Dagnac, T. (2013). Hazardous organic chemicals in rubber recycled tire playgrounds and pavers. Chemosphere 90(2):423-431.

HERO ID: 1597738

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	Medium	Sampling procedure described in general terms, and appears to be reasonable.
	Metric 2:	Analytical Methodology	High	Analytical methodology is described in detail. Analysis performed using GC-MS. Instrumental detection limits are included in Table 1.
	Metric 3:	Biomarker Selection	N/A	Biomarkers are not used in this study.
Domain 2: Representative				
	Metric 4:	Testing Scenario	Medium	Section 3.4 discusses the connection between laboratory conditions and potential real-world scenarios.
	Metric 5:	Sample Size and Variability	Low	17 samples were taken from playground locations and 7 purchased commercially. No indication of replicates being used.
	Metric 6:	Temporality	Medium	Based on publication information, data can be assumed to be between 5 and 15 years old.
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	Raw data is not reported, but summary statistics are relatively complete.
	Metric 8:	Quality Assurance	Medium	Quality control procedures are mentioned briefly.
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Low	There is no specific discussion of variability or uncertainty in the results.

Overall Quality Determination   Medium

Study Citation:	Gu, J., Wensing, M., Uhde, E., Salthammer, T. (2019). Characterization of particulate and gaseous pollutants emitted during operation of a desktop 3D printer. Environment International 123:476-485.		
HERO ID:	5708386		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	Medium	The study consisted of basic thermoplastic filaments used in 3D printing. The filaments were used in a 3D printer as they would normally, but the 3D printer was placed in a stainless steel chamber to capture emissions while in use. The sampling procedure was not cited but it was briefly described in the study.
	Metric 2:	Analytical Methodology	Medium	A GC/MS method was used to analyze the samples.
	Metric 3:	Biomarker Selection	N/A	A biomarker was not used in this study.
Domain 2: Representative				
	Metric 4:	Testing Scenario	Medium	This can potentially be an exposure scenarios in DIY settings.
	Metric 5:	Sample Size and Variability	Medium	Adequate sample size per sampling type.
	Metric 6:	Temporality	High	The paper was published in 2019.
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Low	The study did not provide raw sample data nor an LOD or LOQ. The was provided in tabular format (Table 3).
	Metric 8:	Quality Assurance	Medium	Adequate discussion; Filter sampling of the chamber blank was taken in a separate test (sampling for 4 h in the empty chamber).
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Medium	Adequate discussion of future research direction based on outcomes; Discussed methods that were not successful; Difficulty in obtaining the particle chemical composition due to low concentration and the limitation of the air sampling volume; sample flow rate is limited by the chamber size and air exchange rate; and a short printing time restricts the sampling time.

Overall Quality Determination   Medium

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 Conditions	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 Supplementary file. I do not see that they describe how they created the analysis sample (0.5g aliquot) from a large composite 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:	Lin, W. T., Chen, C. Y., Lee, C. C., Chen, C. C., Lo, S. C. (2021). Air phthalate emitted from flooring building material by the micro-chamber method: Two-stage emission evaluation and comparison. Toxics 9(9):216-216.		
HERO ID:	9384670		

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

Overall Quality Determination   Medium

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

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

Overall Quality Determination   Medium

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

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

Overall Quality Determination   High

Study Citation:	Wang, W., Wu, F. Y., Huang, M. J., Kang, Y., Cheung, K. C., Wong, M. H. (2013). Size fraction effect on phthalate esters accumulation, bioaccessibility and in vitro cytotoxicity of indoor/outdoor dust, and risk assessment of human exposure. Journal of Hazardous Materials 261:753-762.		
HERO ID:	2000934		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Methodology	High	Limited description of the assessment methodology in the main manuscript. Details about the risk assessment are available in the supplementary material.
Domain 2: Representative			
	Metric 2: Exposure Scenario	High	Data closely represent relevant exposure scenarios.
Domain 3: Accessibility/Clarity			
	Metric 3: Documentation of References	High	References are available for all reported data.
Domain 4: Variability and Uncertainty			
	Metric 4: Variability and Uncertainty	Medium	Variability was characterized, uncertainties and limitations were not discussed.

Overall Quality Determination   High

Study Citation:	Chang, J. W., Yan, B. R., Chang, M. H., Tseng, S. H., Kao, Y. M., Chen, J. C., Lee, C. C. (2014). Cumulative risk assessment for plasticizer-contaminated food using the hazard index approach. Environmental Pollution 189:77-84.		
HERO ID:	2345995		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Methodology	High	The study describes sampling, analysis and models in detail.
Domain 2: Representative			
	Metric 2: Exposure Scenario	High	Exposure to phthalates in food.
Domain 3: Accessibility/Clarity			
	Metric 3: Documentation of References	High	Data reported in both main text and supplementary information.
Domain 4: Variability and Uncertainty			
	Metric 4: Variability and Uncertainty	Medium	Variability is reported across the data, no limitations reported.

Overall Quality Determination   High

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

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

Overall Quality Determination   High

Domain	Metric	Rating	Comments
Study Citation:	Li, R., Liang, J., Gong, Z., Zhang, N., Duan, H. (2017). Occurrence, spatial distribution, historical trend and ecological risk of phthalate esters in the Jiulong River, Southeast China. Science of the Total Environment 580(Elsevier):388-397.		
HERO ID:	3483279		
Domain 1: Reliability			
	Metric 1: Methodology	High	Scientifically sound methodology.
Domain 2: Representative			
	Metric 2: Exposure Scenario	High	Data closely represent exposure scenarios of interest.
Domain 3: Accessibility/Clarity			
	Metric 3: Documentation of References	High	References are available for all reported data.
Domain 4: Variability and Uncertainty			
	Metric 4: Variability and Uncertainty	Medium	Characterized variability, limited description of uncertainties.

Overall Quality Determination   High

Study Citation:	Giovanoulis, G., Bui, T., Xu, F., Papadopoulou, E., Padilla-Sanchez, J. A., Covaci, A., Haug, L. S., Cousins, A. P., Magnér, J., Cousins, I. T., de Wit, C. A. (2017). Multi-pathway human exposure assessment of phthalate esters and DINCH. Environment International 112:115-126.		
HERO ID:	4166920		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Monitoring methodology, equipment and storage are reported. Analytical methods and instrument reported. Modeling equations and inputs are reported with references.
Domain 2: Representative				
	Metric 2:	Exposure Scenario	Medium	The study measured daily intake through inhalation, dermal and oral of phthalates. However, sampling was done 2013-104 in Norwegian and may not represent scenarios in the US.
Domain 3: Accessibility/Clarity				
	Metric 3:	Documentation of References	High	References are available for all reported data, inputs, and defaults.
Domain 4: Variability and Uncertainty				
	Metric 4:	Variability and Uncertainty	High	Characterized variability through different media tested. The study discussed uncertainties and limitations.

Overall Quality Determination   High

	Domain	Metric	Rating	Comments
Study Citation:	U.S. Consumer Product Safety Commission (CPSC) (2015). Estimated phthalate exposure and risk to pregnant women and women of reproductive age as assessed using four NHANES biomonitoring data sets (2005/2006, 2007/2008, 2009/2010, 2011/2012).			
HERO ID:	5155509			

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	The study reports the considerations used for daily intakes, hazard quotients and the use of the biomonitoring data.
Domain 2: Representative				
	Metric 2:	Exposure Scenario	High	Phthalate exposure and risk to pregnant women and women of reproductive age.
Domain 3: Accessibility/Clarity				
	Metric 3:	Documentation of References	High	The study reports the references from NHANES data.
Domain 4: Variability and Uncertainty				
	Metric 4:	Variability and Uncertainty	Medium	The study reports variability across different populations.

Overall Quality Determination   High

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

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Medium	Most of the techniques and assumptions cited references, with models providing equations and inputs.
Domain 2: Representative				
	Metric 2:	Exposure Scenario	High	The data closely represent relevant exposure scenarios related to phthalates in water bodies from Canada, consumer products, and biomonitoring daily intakes.
Domain 3: Accessibility/Clarity				
	Metric 3:	Documentation of References	Medium	References are available for most reported data, inputs, and defaults; however, some references may not be publicly available or are not from peer reviewed sources.
Domain 4: Variability and Uncertainty				
	Metric 4:	Variability and Uncertainty	High	Variability (arithmetic mean, percentiles) and uncertainty were characterized in detail throughout the report.

Overall Quality Determination   High

Study Citation:	Christia, C., Poma, G., Harrad, S., De Wit, C. A., Sjostrom, Y., Leonards, P., Lamoree, M., Covaci, A. (2019). Occurrence of legacy and alternative plasticizers in indoor dust from various EU countries and implications for human exposure via dust ingestion and dermal absorption. Environmental Research 171:204-212.		
HERO ID:	5772597		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Methodology	High	Monitoring methods, equipment and storage were reported. Analytical methods and instrument reported. Modeling equations and inputs provided with references.
Domain 2: Representative			
	Metric 2: Exposure Scenario	Medium	The study analyzed exposure to indoor dust, with samples taken from 2016-2017. However, the study was conducted in Europe and may not be representative of the US.
Domain 3: Accessibility/Clarity			
	Metric 3: Documentation of References	High	References are available for all reported data, inputs, and defaults.
Domain 4: Variability and Uncertainty			
	Metric 4: Variability and Uncertainty	Medium	The study characterized variability with different seasons and microenvironments measured. There is no description of uncertainty.

Overall Quality Determination   High

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

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

Overall Quality Determination   High

Study Citation:	Danish EPA, (2011). Annex XV restriction report: Proposal for a restriction, version 2. Substance name: bis(2-ehtylhexyl)phthlate (DEHP), benzyl butyl phthalate (BBP), dibutyl phthalate (DBP), diisobutyl phthalate (DIBP).		
HERO ID:	7265437		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Methodology	High	The assessment uses technical approaches generally accepted by the scientific community and provides detailed methods of sampling, with assumptions, uncertainties in sampling presented.
Domain 2: Representative			
	Metric 2: Exposure Scenario	Medium	Exposure activity assessed likely represents the scenario of interest with consumer product exposures and estimated daily dose from exposure environments (indoor air, household dust, food and biomonitoring results from previous studies) described.
Domain 3: Accessibility/Clarity			
	Metric 3: Documentation of References	Medium	References are available and provided, however some references may not be publicly available or are not from peer reviewed sources.
Domain 4: Variability and Uncertainty			
	Metric 4: Variability and Uncertainty	Medium	Study characterization of variability presented within most results; discussion of key assumptions and study limitations extensive.

Overall Quality Determination   **Medium**

Study Citation:	ECHA, (2012). Committee for Risk Assessment (RAC) Committee for Socio-economic Analysis (SEAC): Background document to the Opinion on the Annex XV dossier proposing restrictions on four phthalates: Annexes.		
HERO ID:	7325405		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Methodology	Medium	The assessment uses technical approaches generally accepted by the scientific community and lacks a literature flow diagram but provides details on databases and search terms utilized.
Domain 2: Representative			
	Metric 2: Exposure Scenario	Medium	Exposure activity assessed likely represents the scenario of interest, some key details on geographic location of sampling lacking but consumer product exposures and estimated daily dose from exposure environments from previous studies described.
Domain 3: Accessibility/Clarity			
	Metric 3: Documentation of References	Medium	References are available and provided, however some references may not be publicly available or are not from peer reviewed sources.
Domain 4: Variability and Uncertainty			
	Metric 4: Variability and Uncertainty	Medium	Study characterization of variability presented within some results; discussion of key assumptions and study limitations and assumptions in exposure modeling presented within text and tables.

Overall Quality Determination   Medium

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

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

Overall Quality Determination   High

Study Citation:		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:	Lin, S., Ku, H., Su, P., Chen, J., Huang, P., Angerer, J., Wang, S. (2011). Phthalate exposure in pregnant women and their children in central Taiwan. Chemosphere 82(7):947-955.		
HERO ID:	699479		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Mathematical Equations	High	Estimated daily intake equation provided with an example calculation; intermediate equation also provided for parent compounds from metabolite concentrations
	Metric 2: Model Evaluation	Low	No evaluation indicated in the study, but assumption of some degree due to peer review publication.
Domain 2: Representative			
	Metric 3: Exposure Scenario	Medium	2011 study with data going back to 2001 limits temporal relevance and data are specific to Taiwanese population, which may limit spatial relevance to US as well.
Domain 3: Accessibility/Clarity			
	Metric 4: Model and Model Documentation Availability	High	Equations and inputs can be followed. Additional documentation not needed.
	Metric 5: Model Inputs and Defaults	High	All inputs are provided with references where needed or calculations where appropriate.
Domain 4: Variability and Uncertainty			
	Metric 6: Variability and Uncertainty	Medium	Some variability in the population and media (exposure via urine, milk, blood vs plastics) discussed. Some discussion of uncertainties around additive effects and secretion fractions.

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:	Mathematical Equations	Low	Equation used to estimate daily intakes not provided. Variables used are described.
	Metric 2:	Model Evaluation	Low	No discussion of model evaluation. Intakes compared to TDIs and assumption of some evaluation based on peer review publication.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Medium	Monitoring data used for concentrations in modeled doses collected from BAMBI survey, specific to German/Bavarian mothers. May not be exactly comparable to US. Study published in 2011.
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	Low	Intake equation(s) not provided.
	Metric 5:	Model Inputs and Defaults	Low	Inputs are provided but cannot validate/ensure relevance without the model equation.
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	Medium	Uncertainties discussed in monitoring/concentration data around detection levels and assumptions made. Some variability in the population of mothers of the infants.

Overall Quality Determination   **Low**

Study Citation:			Schlumpf, M., Kypke, K., Wittassek, M., Angerer, J., Mascher, H., Mascher, D., Vökt, C., Birchler, M., Lichtensteiger, W. (2010). Exposure patterns of UV filters, fragrances, parabens, phthalates, organochlor pesticides, PBDEs, and PCBs in human milk: correlation of UV filters with use of cosmetics. Chemosphere 81(10):1171-1183.
HERO ID:			1249442

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Mathematical Equations	Medium	Equations for intake of chemicals analyzed in milk fat and intake of parabens and phthalates for dose provided in text. No citation provided for parabens and phthalates but appears standard and scientifically sound.
	Metric 2: Model Evaluation	Medium	No indication of evaluation of for parabens and phthalates equation, seems to be conducted by author.
Domain 2: Representative			
	Metric 3: Exposure Scenario	Medium	Exposure is specific to infants ingesting breast milk; the paper proposes a correlation of breast milk concentrations with use of personal care products and certain diets, but that does not necessarily modify the infant intake scenario.
Domain 3: Accessibility/Clarity			
	Metric 4: Model and Model Documentation Availability	Low	Milk fat equation reference provided, but not for parabens and phthalates equation.
	Metric 5: Model Inputs and Defaults	Medium	Daily intake of chemicals by milk are reported in table 7. Some inputs have citations. However, methods for calculations are unclear.
Domain 4: Variability and Uncertainty			
	Metric 6: Variability and Uncertainty	Low	Minimal discussion of variability or uncertainty. Some discussion on the lack of data and studies related to temporal variability of human exposure.

Overall Quality Determination   Medium

		Domain	Metric	Rating	Comments

Study Citation: Frederiksen, H., Nielsen, J. K., Mørck, T. A., Hansen, P. W., Jensen, J. F., Nielsen, O., Andersson, A. M., Knudsen, L. E. (2013). Urinary excretion of phthalate metabolites, phenols and parabens in rural and urban Danish mother-child pairs. International Journal of Hygiene and Environmental Health 216(6):772-783.

HERO ID: 1588874

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Mathematical Equations	Medium	Equations are referenced and from peer reviewed sources.
	Metric 2:	Model Evaluation	Low	Equations are from and in peer reviewed sources; no more formal evaluation mentioned.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Medium	Exposure from 2011; between 5 - 15 years ago.
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	Low	Some of the referenced sources for the equations are not free to the public.
	Metric 5:	Model Inputs and Defaults	High	Model inputs are defined, values are provided and referenced when applicable.
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	Medium	Discussion included on variability and uncertainty; the use of metabolites for parent compounds was addressed.

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:	Mathematical Equations	High	Equation provided and well-described for daily intake calculated from urinary phthalate metabolites (from Kohn et al., 2000). Scenario-based exposure media model (Wormuth et al., 2006) was also used for comparison but was not as well described.
	Metric 2:	Model Evaluation	Medium	Some evaluation and comparison with other models; foreign study.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Medium	Samples collected fall 2007, French study.
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	Low	Limited documentation was provided; additional documentation might be found in cited references.
	Metric 5:	Model Inputs and Defaults	Medium	Inputs are generally identified, especially for calculation of daily intake from metabolites.
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	Medium	Large sample size but study was considered a pilot and some uncertainties were identified.

Overall Quality Determination   **Medium**

Study Citation:	Shen, L., Xia, B., Dai, X. (2013). Residues of persistent organic pollutants in frequently-consumed vegetables and assessment of human health risk based on consumption of vegetables in Huizhou, South China. Chemosphere 93(10):2254-2263.		
HERO ID:	2149595		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Mathematical Equations	High	Weight-specific daily intake equations are provided in section 2.6.
	Metric 2:	Model Evaluation	High	The intake equations appear to be of the standard type, and the results are evaluated by comparing them against similar studies from around the world.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Medium	This study is more than five years old and based on data collected in China, so it may not accurately reflect the US population.
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	High	The intake equations are provided and the required input variables are described.
	Metric 5:	Model Inputs and Defaults	Medium	Model inputs appear to be based partly on monitoring data and survey results, and partly on previous published values which are cited.
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	Medium	There was some discussion of what might account for variation found between different categories of vegetables.

Overall Quality Determination   High

| | | 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:	Mathematical Equations	High	The equation for total daily intake of phthalates as estimated using urinary metabolite concentrations was provided and referenced (David 2000) in Section 2.6, p. 66.
	Metric 2:	Model Evaluation	Medium	Accepted model (David 2000) has been cited in other references.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Medium	Study was conducted 2011-2012 at German daycare centers.
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	Low	Possible incorrect reference citation. Refer to HERO #675063, which includes David 2000 and Kohn et al. 2000; Equation in study under review looks like equation from Kohn et al.
	Metric 5:	Model Inputs and Defaults	High	Model inputs and defaults, with references, are provided in section 2.6, p. 66.
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	Medium	Large study of young children in German daycare centers. Uncertainty is discussed regarding inappropriateness of creatinine-adjustment of samples from children, and also in terms of sample timing relative to half-life of analyses.

Overall Quality Determination   Medium

| Study Citation: | Shin, H. M., Mckone, T. E., Nishioka, M. G., Fallin, M. D., Croen, L. A., Hertz-Picciotto, I., Newschaffer, C. J., Bennett, D. H. (2014). Determining source strength of semivolatile organic compounds using measured concentrations in indoor dust. Indoor Air 24(3):260-271. |
| HERO ID: | 2215665 |

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Mathematical Equations	High	Most equations provided in text, with additional equations and figures provided in the supplemental file with citations; equations for surface area emission rates, gas/dust concentrations, and saturation concentrations.
	Metric 2:	Model Evaluation	Medium	All equations have peer reviewed citations, estimated emission rates only compared to reported values in two studies for DEHP.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Medium	Estimates and models relevant for plastics and building materials but not personal care products.
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	High	Equations are all provided and supplemental documentation is available.
	Metric 5:	Model Inputs and Defaults	Medium	Inputs listed in supplemental table 2 and throughout paper after their relevant equations; most of the inputs are secondary or estimated.
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	High	Uncertainty analysis conducted for the input variables.

Overall Quality Determination   High

Study Citation:	Qian, H., Chen, M., Kransler, K. M., Zaleski, R. T. (2015). Assessment of chemical coexposure patterns based upon phthalate biomonitoring data within the 2007/2008 National Health and Nutrition Examination Survey. Journal of Exposure Science & Environmental Epidemiology 25(3):249-255.
HERO ID:	2345931

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Mathematical Equations	Medium	Equation for daily intakes provided and briefly described, estimating from urinary metabolite concentrations. Equation is cited to David 2000 and Kohn et al 2000 but authors do not specify the specific contributions of each source. The equation for exposure to multiple metabolites is not cited but appears scientifically sound and consistent with single metabolite estimates.
	Metric 2:	Model Evaluation	Medium	Peer review needed for publication, but no specific validation of model or outputs by the authors.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Medium	Daily intakes are based on NHANES 2007-2008 data.
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	Low	Intake equations and inputs are mostly sufficient but the concentrations used from NHANES are not reported in this study for reference.
	Metric 5:	Model Inputs and Defaults	Medium	Fractional urinary excretion rates of the metabolites are tabulated with citations, but other sample data not provided (concentrations, body weights).
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	Medium	Daily intakes estimated for 5, 10, 25, 50, 75, 90, and 95 percentiles. Limited discussion on uncertainties related to singular exposures, but some discussion presented on coexposure patterns.

Overall Quality Determination   Medium

| Study Citation: | Frederiksen, H., Kuiri-Hänninen, T., Main, K. M., Dunkel, L., Sankilampi, U. (2014). A longitudinal study of urinary phthalate excretion in 58 full-term and 67 preterm infants from birth through 14 months. Environmental Health Perspectives 122(9):998-1005. |
| **HERO ID:** | 2347101 |

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Mathematical Equations	Medium	Daily intake equation is provided, briefly described, and appears scientifically sound. Not clear if the entire equation or just the CEsmoothed parameter is cited to Al-Dahhan et al 1988.
	Metric 2:	Model Evaluation	Medium	Proposed model is evaluated for relevance to the scenario and modified accordingly for different phthalates based on previous research, but no other indication of evaluation outside of peer review for publication.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Medium	Mothers included in the Finnish Minipuberty study were recruited between 2006 and 2008.
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	High	The model and documentation (user guide, documentation manual) are publicly available or there is sufficient documentation in the data source or in a companion reference.
	Metric 5:	Model Inputs and Defaults	Medium	Most inputs are identified, described, and provided with particular detail given to the excretion fractions for each metabolite, including references; BW and CE not tabulated.
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	Medium	Median, 70 and 90 percentiles, and maximum daily intakes provided for full term and preterm infant exposures; intakes are presented for each phthalate at four ages (7 days, 2 months, 6 months, 14 months). Uncertainty discussed primarily as it relates to hazard index rather than daily intake, though related. Some uncertainty discussed related to other sources of exposure based on correlations identified between terms. Limitations not described.

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.
Domain 3: Accessibility/Clarity			
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.
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.
Domain 4: Variability and Uncertainty			
Metric 6:	Variability and Uncertainty	Medium	There is some discussion of variation from country to country in similar dietary studies.

Overall Quality Determination   Low

| Study Citation: | Myridakis, A., Fthenou, E., Balaska, E., Vakinti, M., Kogevinas, M., Stephanou, E. G. (2015). Phthalate esters, parabens and bisphenol-A exposure among mothers and their children in Greece (Rhea cohort). Environment International 83:1-10. |
| HERO ID: | 2914665 |

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Mathematical Equations	High	Equation used to estimate daily intake from urinary metabolite concentration provided with citations and description of sound approach.
	Metric 2:	Model Evaluation	Low	Peer reviewed publication of equation, so some evaluation. Urinary concentrations were compared to other studies, which directly impacts estimated daily intakes but daily intake was not directly evaluated.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Medium	Intakes are representative of pregnant Greek women (Rhea project) from 2007-2008.
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	Low	Equation and data are provided, but statistics were done in SPSS which is not free and publicly accessible.
	Metric 5:	Model Inputs and Defaults	High	Model inputs are identified, described, and values are cited when needed.
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	Medium	Median, 95th percentile, maximum, and arithmetic and geometric means provided with 95% CI for both mothers and children; minimum only provided for DEP. Variability characterized for concentrations but not intakes. There is some discussion on exposure patterns in the data.

Overall Quality Determination   Medium

| Study Citation: | Wei, W., Mandin, C., Blanchard, O., Mercier, F., Pelletier, M., Le Bot, B., Glorennec, P., Ramalho, O. (2017). Predicting the gas-phase concentration of semi-volatile organic compounds from airborne particles: Application to a French nationwide survey. Science of the Total Environment 576(Elsevier):319-325. |
| **HERO ID:** | 3454652 |

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Mathematical Equations	Medium	Equations are all referenced from peer reviewed sources; Monte Carlo approach was also described.
	Metric 2:	Model Evaluation	Medium	Validation of new methods used was conducted by the authors.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Low	Data used in study was from 2003-2005.
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	High	All reference equations used are not free to the public (e.g., Wei et al 2016a).
	Metric 5:	Model Inputs and Defaults	High	Inputs are all described (some are in supplemental material).
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	High	Discussion included on uncertainty and variability.

Overall Quality Determination   Medium

Study Citation:	Pelletier, M., Bonvallot, N., Ramalho, O., Mandin, C., Wei, W., Raffy, G., Mercier, F., Blanchard, O., Le Bot, B., Glorennec, P. (2017). Indoor residential exposure to semivolatile organic compounds in France. Environment International 109:81-88.		
HERO ID:	4165791		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Mathematical Equations	Medium	All equations are cited and from peer reviewed sources
Metric 2:	Model Evaluation	High	Methods and Crystal Ball software are well known and have undergone evaluation
Domain 2: Representative			
Metric 3:	Exposure Scenario	Medium	Exposure data from previously published studies; 5-15 years ago
Domain 3: Accessibility/Clarity			
Metric 4:	Model and Model Documentation Availability	Low	all referenced materials for the modeling methods are not free and available to the public
Metric 5:	Model Inputs and Defaults	High	All inputs are defined and values referenced (when applicable); Crystal Ball was used I a probabilistic risk assessment so exact values are not always available
Domain 4: Variability and Uncertainty			
Metric 6:	Variability and Uncertainty	High	Included relative contribution of key parameters

Overall Quality Determination   **Medium**

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

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

Overall Quality Determination   **High**

Domain		Metric	Rating	Comments
Study Citation:		Weiss, J. M., Gustafsson, Å., Gerde, P., Bergman, Å., Lindh, C. H., Krais, A. M. (2018). Daily intake of phthalates, MEHP, and DINCH by ingestion and inhalation. Chemosphere 208:40-49.		
HERO ID:		4728899		
Domain 1: Reliability				
	Metric 1:	Mathematical Equations	High	Inhalation and ingestion exposure equations are provided in the paper.
	Metric 2:	Model Evaluation	High	Ingestion intake equation is cited from a previous published paper; inhalation intake equation seems mathematically sound. MPPD model used for calculating inhalation parameters appears well-attested.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Medium	This is a recent paper, though it is based on data from Sweden rather than the US.
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	High	Inhalation and ingestion exposure equations are provided in the paper itself. The MPPD model used to calculate inhalation parameters appears to be freely available online.
	Metric 5:	Model Inputs and Defaults	High	Input values are cited throughout the paper, and come from the MPPD model or other reputable sources.
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	Medium	There is some discussion of variance and the limitations of the study, though these seem to apply mainly to the monitoring portion.

Overall Quality Determination   High

Study Citation: Okeme, J. O., Nguyen, L. V., Lorenzo, M., Dhal, S., Pico, Y., Arrandale, V. H., Diamond, M. L. (2018). Polydimethylsiloxane (silicone rubber) brooch as a personal passive air sampler for semi-volatile organic compounds. Chemosphere 208:1002-1007.

HERO ID: 5017615

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Mathematical Equations	Low	Simple calculation to determine inhalation exposure was described in data source but no equation was provided.
	Metric 2: Model Evaluation	Medium	For evaluation, exposure results were compared with results from an 8-hr sample using a different collection method.
Domain 2: Representative			
	Metric 3: Exposure Scenario	High	Canadian study was published in 2018.
Domain 3: Accessibility/Clarity			
	Metric 4: Model and Model Documentation Availability	Low	There is limited description of the simple inhalation exposure model but there may be additional information in the reference for inhalation rate (USEPA 2011, Exposure Factors Handbook).
	Metric 5: Model Inputs and Defaults	Medium	Model inputs and defaults are generally identified, described and referenced.
Domain 4: Variability and Uncertainty			
	Metric 6: Variability and Uncertainty	Medium	The study characterizes and discusses variability in the personal air concentration inputs and sampling rates used in the exposure calculation. Uncertainty and data limitations are also discussed.

Overall Quality Determination   Medium

Study Citation:	Velázquez-Gómez, M., Hurtado-Fernández, E., Lacorte, S. (2019). Differential occurrence, profiles and uptake of dust contaminants in the Barcelona urban area. Science of the Total Environment 648:1354-1370.		
HERO ID:	5043338		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Mathematical Equations	High	Total daily intake equation provided, explained, and cited.
	Metric 2: Model Evaluation	Medium	Exposure levels compared to other published studies for similarity.
Domain 2: Representative			
	Metric 3: Exposure Scenario	Medium	Dust exposure is a relevant scenario, but the concentrations used in the exposure calculations may not be transferrable to US as they are from Spanish monitoring studies. Additionally, the time of collection is not specified, but refers to a previous sampling study.
Domain 3: Accessibility/Clarity			
	Metric 4: Model and Model Documentation Availability	High	Equations are given and references included. Exposure estimation methods based on Cristale et al 2018 and Gevao et al 2006.
	Metric 5: Model Inputs and Defaults	High	Key inputs (dust ingestion rates) are from Ali et al 2012 and Jones-Otazo et al 2005 for mean and high exposure situations.
Domain 4: Variability and Uncertainty			
	Metric 6: Variability and Uncertainty	Medium	Not much discussion included about uncertainty and variability. Median and high scenarios based on concentrations from multiple locations. Toddlers and teenagers considered separately from adults as "staff" at the key locations.

Overall Quality Determination   **High**

Study Citation:	Wei, W., Mandin, C., Blanchard, O., Mercier, F., Pelletier, M., Le Bot, B., Glorennec, P., Ramalho, O. (2019). Semi-volatile organic compounds in French dwellings: An estimation of concentrations in the gas phase and particulate phase from settled dust. Science of the Total Environment 650 Pt. 2:2742-2750.		
HERO ID:	5043472		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Mathematical Equations	Medium	Concentration and intermediate equations provided with citations and explanations.
	Metric 2: Model Evaluation	Medium	Validation through comparing predicted and measured values with previous studies in similar environments/conditions; high R2 values for gas phase conc and particular phase equations/values.
Domain 2: Representative			
	Metric 3: Exposure Scenario	Medium	Exposure to SVOCs via indoor dust is a relevant and current exposure scenario, but this study and methods are based on data inside French homes.
Domain 3: Accessibility/Clarity			
	Metric 4: Model and Model Documentation Availability	High	Equations all detailed and cited, can be followed to repeat the process.
	Metric 5: Model Inputs and Defaults	High	Inputs to all equations provided and cited where applicable.
Domain 4: Variability and Uncertainty			
	Metric 6: Variability and Uncertainty	Medium	Variability and uncertainty in results discussed for different chemicals based on reported concentrations (secondary data) and equilibrium of gaseous/particulate phases.

Overall Quality Determination   Medium

Study Citation:	Giovanoulis, G., Nguyen, M. A., Arwidsson, M., Langer, S., Vestergren, R., Lagerqvist, A. (2019). Reduction of hazardous chemicals in Swedish preschool dust through article substitution actions. Environment International 130:104921.		
HERO ID:	5412073		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Mathematical Equations	High	Daily intake equation provided and described. No source or citation for the equation but appears scientifically sound.
Metric 2:	Model Evaluation	Low	No discussion of model evaluation in the study, but assumption of some evaluation during peer review process.
Domain 2: Representative			
Metric 3:	Exposure Scenario	Medium	Dust exposure in preschools is realistic scenario, but preschools sampled are in Sweden, potentially limiting the comparative value to the US.
Domain 3: Accessibility/Clarity			
Metric 4:	Model and Model Documentation Availability	High	Equation provided to follow calculations of daily intakes.
Metric 5:	Model Inputs and Defaults	Medium	All inputs provided. BW cited to EPA and concentration of dust in the monitoring samples, but ingestion rates not cited.
Domain 4: Variability and Uncertainty			
Metric 6:	Variability and Uncertainty	Medium	Intermediate and high ingestion rates considered, and daily intakes presented for median, mean, and 95th percentile concentrations. Correlation considerations provided in supplemental file. Limited discussion of uncertainties related to monitoring samples used in model.

Overall Quality Determination   **Medium**

Study Citation:	Luongo, G., Oestman, C. (2016). Organophosphate and phthalate esters in settled dust from apartment buildings in Stockholm. Indoor Air 26(3):414-425.		
HERO ID:	5469670		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Mathematical Equations	Medium	No equation is provided but model is described in words and assumed to be: household dust contribution to daily dust intake, as fraction x [(dust ingestion rate x concentration in indoor dust)/bw]. Determinations made using various inputs and defaults for average and high intake scenarios with adults and toddlers agreed with Table 6 reported values.
	Metric 2:	Model Evaluation	Medium	Study monitoring data used as inputs were compared with literature values. General calculations for intake values widely used but no validation for their specific scenario.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Medium	This study was conducted in 2008 in Sweden.
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	High	There appears to be sufficient documentation in data source and/or possibly references.
	Metric 5:	Model Inputs and Defaults	Medium	Model inputs & defaults are generally identified, referenced and described.
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	Medium	Average and high estimated daily dust exposures were determined for adults and toddlers with some discussion of uncertainty and limitations.

Overall Quality Determination   **Medium**

Study Citation:	Promtes, K., Kaewboonchoo, O., Kawai, T., Miyashita, K., Panyapinyopol, B., Kwonpongsagoon, S., Takemura, S. (2019). Human exposure to phthalates from house dust in Bangkok, Thailand. Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 11(13):1-7.		
HERO ID:	5532759		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Mathematical Equations	Medium	Daily intake equation is provided with multiple citations, but it is not clear how each source was used or if they all use the same model.
	Metric 2: Model Evaluation	High	Model estimates compared to doses cited from other studies and are compared to US EPA RfDs. References are peer reviewed.
Domain 2: Representative			
	Metric 3: Exposure Scenario	Medium	Estimates are based on 2017 concentrations collected in Thailand and ingestion and body weights of Thai adults and children. This may limit the relevance to US exposure scenarios.
Domain 3: Accessibility/Clarity			
	Metric 4: Model and Model Documentation Availability	High	DI equation and needed inputs are provided and sufficient to follow the calculations.
	Metric 5: Model Inputs and Defaults	Medium	Inputs for dust ingestion and body weight are provided, concentrations are reported in table 2.
Domain 4: Variability and Uncertainty			
	Metric 6: Variability and Uncertainty	Medium	Discussion of limitations addressed the sampling methods primarily rather than the modeling methodology. Ingestion exposure estimated based on low-end and high-end rates for three housing scenarios.

Overall Quality Determination   **Medium**

Study Citation:	Weiss, J. M., Gustafsson, Å., Gerde, P., Bergman, Å., Lindh, C. H., Krais, A. M. (2018). Daily intake of phthalates, MEHP, and DINCH by ingestion and inhalation. Chemosphere 208:40-49.		
HERO ID:	5550408		

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Mathematical Equations	High	All EDI equations were provided with cited references from peer reviewed sources and discussed in detail.
	Metric 2:	Model Evaluation	Low	The study does not provide any discussion on model evaluation but some level of validation is assumed based on the study being a peer reviewed article.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	High	This is a Swedish study conducted in 2018 (<5 years ago). Inhalation and ingestion of phthalates from indoor dust is considered a relevant exposure scenario for both children and adults.
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	High	The model equations are clearly defined and and additional documentation is not required to follow how they were used for these exposure scenarios.
	Metric 5:	Model Inputs and Defaults	High	The model inputs were referenced and clearly defined along with any assumptions made. Most inputs were retrieved from the child specific exposure factors handbook.
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	Medium	The study characterized daily intake variability using two age groups (adults and children) and two exposure pathways (incidental ingestion and inhalation). Very limited discussion was provided concerning study uncertainties, limitations, and data gaps.

Overall Quality Determination   High

| 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:	Mathematical Equations	High	Equation for estimated daily intake of parent phthalate from concentration of urinary phthalate metabolites. Reference citation was also provided (Koch et al. 2007).
	Metric 2:	Model Evaluation	Medium	Limited evaluation was evident in terms of comparison with other studies and analytical method validation of input concentrations. It can be assumed that the model has undergone peer evaluation.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Medium	Study was conducted in 2017; population was Saudi Arabian children.
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	High	Koch reference is frequently cited for estimated daily intake; documentation is likely available.
	Metric 5:	Model Inputs and Defaults	High	Model inputs and defaults are identified, referenced and clearly described. QA/QC concentration data are provided in SI Table S1.
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	High	Variability of concentrations was studied and summarized in Table 2. Recommended that study be validated in larger populations using longitudinal study design.

Overall Quality Determination   High

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

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

Overall Quality Determination   Medium

Study Citation:	SUNY, (2019). Semi-volatile organic compounds in infant homes: Levels, influence factors, partitioning, and implications for human exposure. Environmental Pollution 251:609-618.		
HERO ID:	6815979		

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Mathematical Equations	High	Equations provided for EDI via air inhalation, air dermal absorption, dust non-dietary ingestion, dust dermal absorption. All equations are described in detail and have citations, some US EPA.
Metric 2:	Model Evaluation	Medium	Model evaluation not directly conducted by author, but models are secondary. Assumed peer review and some evaluation during initial publication.
Domain 2: Representative			
Metric 3:	Exposure Scenario	Medium	Model inputs seem appropriate for estimating total daily intakes for infants via dust and air; not all intermediate values provided for each route and the population is limited to the region in China.
Domain 3: Accessibility/Clarity			
Metric 4:	Model and Model Documentation Availability	High	Model equations and inputs are sufficient.
Metric 5:	Model Inputs and Defaults	Medium	Inputs are described and values provided with citations; data quality criteria not discussed but values appear appropriate.
Domain 4: Variability and Uncertainty			
Metric 6:	Variability and Uncertainty	Medium	The study characterizes the variability in intakes across chemicals but for a single population (infants) and in one scenario (combined air and dust); correlation analysis conducted to identify major routes and influence of each chemical.

Overall Quality Determination   Medium

Table 414: Glossary of Select Terms for Data Evaluation

Term	Definition
ADD	Average daily dose
ADC	Average daily concentration
BBP	Butyl benzyl phthalate
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
COC	Concentration of concern
CPSC	Consumer Product Safety Commission
CRA	Cumulative risk assessment
CWA	Clean Water Act
DBP	Dibutyl phthalate
DCHP	Dicyclohexyl phthalate
DEHP	Diethylhexyl phthalate
DIBP	Diisobutyl phthalate
DIDP	Diisodecyl phthalate
DINP	Dicyclohexyl phthalate
DIY	Do-it-yourself
DMR	Discharge Monitoring Report
EPA	Environmental Protection 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

Table 414 ... continued from previous page

Term	Definition
LOAEL	Lowest-observed-adverse-effect level
Log K_{OC}	Logarithmic organic carbon: water partition coefficient
Log K_{OW}	Logarithmic octanol: water partition coefficient
MOA	Mode of action
MOE	Margin of exposure
NAICS	North American Industry Classification System
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
OEV	Occupational exposure value
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
PV	Production volume
PVC	Polyvinyl chloride
REL	Recommended Exposure Limit
RPF	Relative potency factor
RQ	Risk quotient
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

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