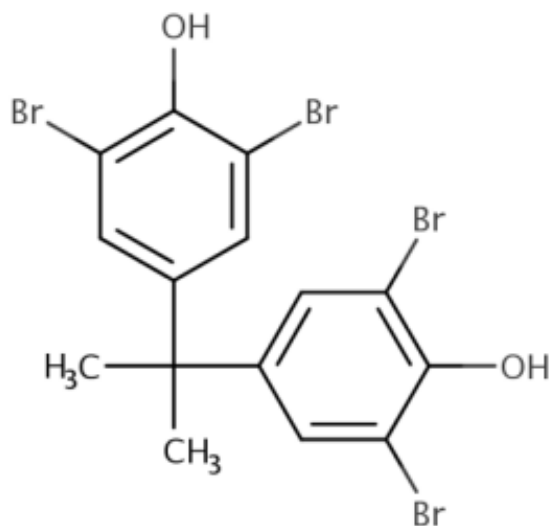

**Draft Data Quality Evaluation Information for
General Population, Consumer, and Environmental Exposure for
4,4-(1-Methylethylidene)bis[2,6-dibromophenol] (TBBPA)**

Systematic Review Support Document for the Draft Risk Evaluation

CASRN: 79-94-7



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This supplemental file contains information regarding the data quality evaluation results for data sources that met the PECO (Population, Exposure, Comparator or Scenario, and Outcomes) screening criteria for the *Draft Consumer and Indoor Exposure Assessment for 4,4'-(1-Methylethylidene)bis[2, 6-dibromophenol] (TBBPA)*, and the *Draft Environmental Media and General Population and Environmental Exposure for 4,4'-(1-Methylethylidene)bis[2, 6-dibromophenol] (TBBPA)*. 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*. (referred hereafter as the “2021 Draft Systematic Review Protocol”). The systematic review steps are further described in the *Draft Systematic Review Protocol for 4,4'-(1-Methylethylidene)bis[2, 6-dibromophenol] (TBBPA)*.

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 *Draft Data Quality Evaluation Information for General Population, Consumer, and Environmental Exposure for 4,4'-(1-Methylethylidene)bis[2, 6-dibromophenol] (TBBPA)*.

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Glossary of Select Terms for Data Evaluation Tables		261

Study Citation:		Brandli, R. C., Kupper, T., Bucheli, T. D., Zennegg, M., Huber, S., Ortelli, D., Muller, J., Schaffner, C., Iozza, S., Schmid, P., Berger, U., Edдер, P., Oehme, M., Stadelmann, F. X., Tarradellas, J. (2007.0). Organic pollutants in compost and digestate. Part 2. Polychlorinated dibenzo-p-dioxins, and -furans, dioxin-like polychlorinated biphenyls, brominated flame retardants, perfluorinated alkyl substances, pesticides, and other compounds. Journal of Environmental Monitoring 9(5):465-72.		
HERO ID:		198168		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling described in Brandli et al. 2006.
	Metric 2:	Analytical Methodology	Low	Analysis described in other papers.
	Metric 3:	Biomarker Selection	N/A	Parent chemical collected in environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Switzerland.
	Metric 5:	Currency	Low	Timing of sample collection for monitoring data is not reported, discussed, or referenced however publication year, 2007, is used as surrogate for sampling year.
	Metric 6:	Spatial and Temporal Variability	Medium	The study collected a total of 13 compost samples and 5 digestate, no replicates.
	Metric 7:	Exposure Scenario	Low	The study evaluates compost.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Table S2 has raw data.
	Metric 9:	Quality Assurance	Low	QA refers to other papers.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty not discussed, but raw data are presented.
Overall Quality Determination			Low	

Study Citation:		Takigami, H., Suzuki, G., Hirai, Y., Sakai, S. (2009.0). Brominated flame retardants and other polyhalogenated compounds in indoor air and dust from two houses in Japan. Chemosphere 76(2):270-277.		
HERO ID:		198241		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methods were mostly described in detailed, but storage conditions and duration were missing.
	Metric 2:	Analytical Methodology	Low	The detection limits for bromine and antimony (a flame retardant synergist) were reported, but not for TBBPA itself.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in indoor air and dust.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Japan.
	Metric 5:	Currency	Medium	Samples were collected in 2006.
	Metric 6:	Spatial and Temporal Variability	Medium	Outdoor air, exhaust, indoor air on two different floors, and dust were collected without replicates. There were dozens of samples collected from household products, but they were analyzed for bromine and antimony.
	Metric 7:	Exposure Scenario	High	Exposure to TBBPA via indoor air and dust from is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual concentration data are available but not summary statistics.
	Metric 9:	Quality Assurance	High	A detailed QA/QC description was provided, including acceptable recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Limited characterization of variability, uncertainties and study limitations
Overall Quality Determination			Medium	

Study Citation:		Palmquist, H., Hanaeus, J. (2005.0). 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 9), 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. (2008.0). 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:		Abb, M., Stahl, B., Lorenz, W. (2011.0). Analysis of brominated flame retardants in house dust. Chemosphere 85(11):1657-1663.		
HERO ID:		787629		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The description of sampling methodology was limited to number of households, sample matrix (i.e., vacuum cleaner bags), and sieving step.
	Metric 2:	Analytical Methodology	High	Detailed analytical methods and LODs were reported.
	Metric 3:	Biomarker Selection	N/A	Study measured TBBPA in household dust.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was performed in Germany (24 homes) and USA (2 homes).
	Metric 5:	Currency	Low	Study was published in 2011. No sampling data was available.
	Metric 6:	Spatial and Temporal Variability	Medium	A total of 26 samples was collected without replicates.
	Metric 7:	Exposure Scenario	High	Exposure to TBBPA via household dust is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only median and averages were provided. Individual sample concentrations were presented visually without accompanying precise numbers.
	Metric 9:	Quality Assurance	High	Analyzed control samples, blanks, and spikes. Calibration was included. Recoveries were acceptable.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Key uncertainties and study limitations and variance were not discussed.
Overall Quality Determination			Medium	

Study Citation:		Abdallah, M. A. E., Harrad, S. (2011.0). Tetrabromobisphenol-A, hexabromocyclododecane and its degradation products in UK human milk: Relationship to external exposure. Environment International 37(2):443-448.		
HERO ID:		787631		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The study protocol was approved by Warwickshire Research Ethics Committee and the R&D Department in Birmingham Women’s NHS foundation trust.
	Metric 2:	Analytical Methodology	High	Extraction and analytical methods, instrument, calibration reported. Method limits of quantification (LOQ) were estimated based on 10:1 S:N ratios and were 22, 36, 26 and 30 pg g-1 lw for TBBP-A, HBCDs, TBCDs and PBCDs respectively.
	Metric 3:	Biomarker Selection	N/A	Measuring TBBPA in breast milk.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	UK
	Metric 5:	Currency	Low	Sampling date not provided. Study published in 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	34 samples. No replicates.
	Metric 7:	Exposure Scenario	High	Measuring the chemical in breast milk.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data reported in supplemental file. Summary statistics, such as average, SD, median, min, max, 5th and 95th percentile, max reported.
	Metric 9:	Quality Assurance	High	Key QA reported and high recoveries for TBBP (>70%). For TBBP-A, in the absence of an appropriate standard reference material, a standard addition or “matrix spike” method at 3 concentration levels (n= 5 at each level) was used to assess the accuracy and precision of the method and good results were obtained.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Reported SD as a measure of variance. Few gaps and limitations reported.
Overall Quality Determination			High	

Study Citation:		Antignac, J. P., Cariou, R., Maume, D., Marchand, P., Monteau, F., Zalko, D., Berrebi, A., Cravedi, J. P., Andre, F., Le Bizec, B. (2008.0). Exposure assessment of fetus and newborn to brominated flame retardants in France: Preliminary data. Molecular Nutrition and Food Research 52(2):258-265.		
HERO ID:		787643		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	No information on sampling equipment, sampling procedure, and sample storage. Study site was described as the Paule de Viguier Hospital and referenced sampling protocol was approved by ethics board.
	Metric 2:	Analytical Methodology	Low	
	Metric 3:	Biomarker Selection	High	Extraction, instrumentation, and recovery samples were reported. No calibration information or LOQ/LOD was reported.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study tested parent chemicals in serum, adipose tissue, and breast milk.
	Metric 5:	Currency	Medium	Samples were collected in France.
	Metric 6:	Spatial and Temporal Variability	Medium	Samples were collected in 2005.
	Metric 7:	Exposure Scenario	Medium	26 samples were collected for each scenario without replicates.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Number of samples, range, and mean/average were reported. No raw data and no other summary statistics were provided.
	Metric 9:	Quality Assurance	Low	
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Internal standards were used but recoveries and other QA/QC techniques were not reported.
Overall Quality Determination			Medium	

Study Citation: Sjödin, A., Carlsson, H., Thuresson, K., Sjölin, S., Bergman, Å., Östman, C. (2001.0). Flame retardants in indoor air at an electronics recycling plant and at other work environments. Environmental Science & Technology 35(3):448-454.

HERO ID: 947816

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Sampling Methodology	Medium	Sample storage duration was not reported.
	Metric 2: Analytical Methodology	Critically Deficient	The study reports that the LOQ was defined as 10 times the average background in blank samples because small amounts of interfering peaks were present in the blank samples. Additionally, this chemical was not detected at the outdoor site, and a LOD was not determined.
	Metric 3: Biomarker Selection	N/A	Concentrations were measured in air.
Domain 2: Representativeness	Metric 4: Geographic Area	High	The study did not explicitly report the country in which the sampled teaching halls and offices were located, but the location is assumed to be Stockholm because the outdoor air samples were reported to have been collected there.
	Metric 5: Currency	Low	No sampling date is reported, but a publication date is available.
	Metric 6: Spatial and Temporal Variability	Medium	Only 4 samples were collected from office space and only 2 samples collected from a teaching hall. Two outdoor air samples were also collected. (Other sampling sites were factory/plant settings).
	Metric 7: Exposure Scenario	Medium	Only two relevant indoor sites (office and teaching hall) and one outdoor site were sampled.
Domain 3: Accessibility/Clarity	Metric 8: Reporting of Results	Medium	For the office air measurements, only a mean concentration and a range were reported (no measure of variation).
	Metric 9: Quality Assurance	Low	Recovery was low (60%).
Domain 4: Variability and Uncertainty	Metric 10: Variability and Uncertainty	Low	The study didn't include a discussion of quality assurance/quality control.

Overall Quality Determination

Uninformative

Study Citation:		Batterman, S., Godwin, C., Chernyak, S., Jia, C., Charles, S. (2010.0). Brominated flame retardants in offices in Michigan, USA. Environment International 36(6):548-556.		
HERO ID:		1010575		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods for each type of location, equipment, storage conditions, study site all reported. The study used different types of sampling.
	Metric 2:	Analytical Methodology	Medium	Extraction and analytical methods, instrument, calibration, recovery methods, MDL were reported. MDL reported as PBDE congener and not individual chemical though.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was conducted in the United States.
	Metric 5:	Currency	Medium	Samples were collected in 2006-2007.
	Metric 6:	Spatial and Temporal Variability	Medium	12 samples for dust, 18 for vapor, 13 for PM. Some locations had duplicates sampled on different dates.
	Metric 7:	Exposure Scenario	High	Measuring chemical in indoor dust, vapor, and PM from university buildings.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported, only for each building location. Mean and median reported.
	Metric 9:	Quality Assurance	High	Key QA has been reported and recoveries were over 70%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Key uncertainties and limitations of the study were reported. Variation in the study sites, types of samples, and collection of duplicate samples in different times.
Overall Quality Determination			High	

Study Citation:		Guerra, P., Eljarrat, E., Barceló, D. (2010.0). Simultaneous determination of hexabromocyclododecane, tetrabromobisphenol A, and related compounds in sewage sludge and sediment samples from Ebro River basin (Spain). Analytical and Bioanalytical Chemistry 397(7):2817-2824.		
HERO ID:		1040997		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Key sampling methods missing such as equipment and procedure used to collect samples.
	Metric 2:	Analytical Methodology	High	Key analytical methods reported such as extraction and analytical methods, calibration, instrument, and LOD/LOQ.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Spain
	Metric 5:	Currency	Medium	Samples collected in 2006 and 2008.
	Metric 6:	Spatial and Temporal Variability	Medium	14 samples (7 from sludge and 7 from sediment) shown in table 4. No replicates.
	Metric 7:	Exposure Scenario	High	Measuring the chemical in sewer sludge and sediment from WWTP.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data reported. No summary statistics.
	Metric 9:	Quality Assurance	Medium	Method validation and QA reported. For each method, three blanks and four repetitions were prepared. 6 compound recoveries were over 70%, one was 30% (table 2).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Sensitivity was evaluated by determining the method detection limits and variation measured in sewer sludge and sediment. However, no SD was reported. Limitations also not reported.
Overall Quality Determination			Medium	

Study Citation:		Harrad, S., Goosey, E., Desborough, J., Abdallah, M. A. E., Roosens, L., Covaci, A. (2010.0). Dust from U.K. primary school classrooms and daycare centers: The significance of dust as a pathway of exposure of young U.K. children to brominated flame retardants and polychlorinated biphenyls. Environmental Science & Technology 44(11):4198-4202.		
HERO ID:		1076646		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling procedures, equipment, study site, and storage described.
	Metric 2:	Analytical Methodology	Low	LOD not reported, but the study mentions that in all instances,where concentrations were below the detection limit, the concentration was assumed to equal half of the detection limitfor the purposes of statistical analyses. Detailed description of analytical methods in SI, including extraction and analytical procedures. Cited previously published work.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	UK
	Metric 5:	Currency	Medium	Sampling in 2007 and 2008.
	Metric 6:	Spatial and Temporal Variability	Medium	43 samples in total. No replicates.
	Metric 7:	Exposure Scenario	High	Data closely represents relevant exposure scenarios, conducted exposure assessment for sampling indoor dust in children’s environments.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data in SI. Reported summary statistics (minimum, 5th percentile, median, mean, 95th, percentile maximum). No standard deviation reported.
	Metric 9:	Quality Assurance	Medium	QA/QC discussed in SI, the study determined recoveries but did not report values.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	No discussion of uncertainties and study limitations. Variation measured in different types of study sites, times, and comparison of results to other studies.
Overall Quality Determination			Medium	

Study Citation:		Abdallah, M. A., Harrad, S., Covaci, A. (2008.0). Hexabromocyclododecanes and tetrabromobisphenol-A in indoor air and dust in Birmingham, U.K: Implications for human exposure. Environmental Science & Technology 42(18):6855-6861.		
HERO ID:		1079114		
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	High	Analytical instrumentation and methods are described in sufficient detail, including the method quantification limit for the analyte of interest. Extraction information was presented most clearly for the dust samples.
	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	United Kingdom
	Metric 5:	Currency	Medium	2006-2007
	Metric 6:	Spatial and Temporal Variability	Medium	Air and dust samples were collected from various microenvironments with sample numbers ranging from 4 to 45; only one of four categories of each sample type had fewer than 5 samples. However, no replicate samples were collected.
	Metric 7:	Exposure Scenario	Medium	This study analyzes environmental samples with consideration of actual human exposure (i.e. under normal room use conditions for indoor samples), and the types of environments sampled are well documented. While no "control" samples were collected, it is hard to come by "everyday" locations people use where this chemical would not be expected to be found. Sources of exposure appear not to have been methodically investigated in the locations sampled, but there is a comment about surveying for items potentially treated with flame retardants in the home with the highest concentrations of HBCD measured.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data are reported in the supplemental materials; summary statistics are also reported, including average, standard deviation, minimum, medium, and maximum.
	Metric 9:	Quality Assurance	High	QA/QC measures included the use of internal standards, method blanks, and matrix spikes; good recoveries (averages 80-99%) were reported for the internal standards and spikes.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Standard deviation values (reflecting variability) were reported for each sample group, although authors acknowledge that some groups are too small for meaningful statistical analysis. The authors offered, where they could, potential reasons for differences in chemical levels present in different microenvironments. Other than the small sample size from public microenvironments, no other limitations are discussed. The only uncertainty discussed was why levels of HBCDs were considerably higher in one home than the others.
Overall Quality Determination			High	

Study Citation:		Harrad, S., Abdallah, M. A. (2011.0). Brominated flame retardants in dust from UK cars—within-vehicle spatial variability, evidence for degradation and exposure implications. Chemosphere 82(9):1240-1245.		
HERO ID:		1082335		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods such as procedure, equipment, spots sampled, and storage detailed.
	Metric 2:	Analytical Methodology	Low	Detailed analytical and extraction methods, equipment. Did not report calibration or LOD for TBBPA, these may be in the article referenced.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	UK
	Metric 5:	Currency	Medium	Sampling in 2009.
	Metric 6:	Spatial and Temporal Variability	Medium	14 vehicles sampled in car cabin and trunk (28 total). No replicates.
	Metric 7:	Exposure Scenario	High	Measuring the chemical in car trunks.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations in table S3 and S4. Only median as summary statistic was provided.
	Metric 9:	Quality Assurance	High	Detailed description of QA/QC techniques. Field blanks and high recoveries (>70%) reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Compared different spots in the cars, but variability was not statistically characterized (e.g. SD, 95 CI were not provided). Uncertainties were only briefly discussed.
Overall Quality Determination			Medium	

Study Citation:		Salapasidou, M., Samara, C., Voutsas, D. (2011.0). Endocrine disrupting compounds in the atmosphere of the urban area of Thessaloniki, Greece. Atmospheric Environment 45(22):3720-3729.		
HERO ID:		1249468		
Domain		Metric	Rating	Comments
Domain 1: Reliability		Metric 1: Sampling Methodology	High	Sampling equipment and methods are described in sufficient detail and are scientifically sound.
	Metric 2:	Analytical Methodology	Low	Analytical instrumentation and methods are described in sufficient detail and are scientifically sound. However, neither LOD nor LOQ is reported.
	Metric 3:	Biomarker Selection	N/A	This study is testing for the parent chemical of interest in an environmental medium (air).
Domain 2: Representativeness		Metric 4: Geographic Area	High	Thessaloniki, Greece
	Metric 5:	Currency	Medium	2007
	Metric 6:	Spatial and Temporal Variability	High	24-hour air samples from two sites (10 at each site)
	Metric 7:	Exposure Scenario	High	Each air sampling site was characterized as either urban-traffic or urban-industrial. Pertinent meteorological data were also incorporated into analysis.
Domain 3: Accessibility/Clarity		Metric 8: Reporting of Results	Medium	Raw data are not reported; summary statistics include frequency of detection, mean, standard deviation, median, minimum, and maximum concentration at each site.
	Metric 9:	Quality Assurance	High	Authors followed criteria concerning the performance of analytical methods as reported in Commission Decision 2002/657/EC as well as quantification by internal standard. Matrix spiked recoveries were within acceptable ranges.
Domain 4: Variability and Uncertainty		Metric 10: Variability and Uncertainty	Medium	Standard deviation is reported and indicates high variability at each sampling site. There is some discussion of limitations or sources of uncertainty in the methodology.
Overall Quality Determination			High	

Study Citation:		Driffield, M., Harmer, N., Bradley, E., Fernandes, A. R., Rose, M., Mortimer, D., Dicks, P. (2008.0). Determination of brominated flame retardants in food by LC-MS/MS: Diastereoisomer-specific hexabromocyclododecane and tetrabromobisphenol A. Food Additives & Contaminants: Part A, Chemistry, Analysis, Control, Exposure & Risk Assessment 25(7):895-903.		
HERO ID:		1252276		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
Metric 1:	Sampling Methodology	Medium	Methods for obtaining the shellfish samples that are the primary focus of this study were not detailed. Similarly, sampling methods for the Total Diet Study (TDS) were brief. We know samples were collected every fortnight at different locations "throughout the UK", but not how many samples or sample locations were used. Nor do we know if the samples were purchased at grocery stores, farmers' markets, or elsewhere. This information is likely in other sources. Samples were stored frozen, but we don't know for how long.	
Metric 2:	Analytical Methodology	High	Analytical methods were described in detail. For the shellfish study, they reported LODs for each sample because the masses sampled varied. For the TDS study, a single LOD is reported for fish, and there are various other LODs shown for other types of food. They used blanks and standards, and they calculated recoveries.	
Metric 3:	Biomarker Selection	N/A	Samples were analyzed for TBBPA in food.	
Domain 2: Representativeness				
Metric 4:	Geographic Area	High	UK for TDS and Scotland for shellfish samples	
Metric 5:	Currency	Medium	Samples of shellfish from Scotland were from 2006. The TDS samples were from 2004.	
Metric 6:	Spatial and Temporal Variability	High	35 composite shellfish samples from diverse locations in Scotland (some locations had multiple samples collected). Duplicate samples were analyzed.	
Metric 7:	Exposure Scenario	Medium	Data closely represent relevant exposure scenarios. Differences in potential sources of exposure to the shellfish were not discussed. There were no exposure "controls".	
Domain 3: Accessibility/Clarity				
Metric 8:	Reporting of Results	Medium	Individual sample concentrations were reported, but there were no summary statistics.	
Metric 9:	Quality Assurance	High	QA/QC techniques were thorough and well-described, including use of blanks and standards, determination of and correction for recoveries, etc. There were no pre-exposure samples possible.	
Domain 4: Variability and Uncertainty				
Metric 10:	Variability and Uncertainty	Medium	There was minimal characterization of variability (e.g., comparisons to data from other studies). The only discussion of uncertainty related to measurement uncertainty. There was no discussion of study limitations.	
Overall Quality Determination			High	

Study Citation:		Kawashiro, Y., Fukata, H., Omori-Inoue, M., Kubonoya, K., Jotaki, T., Takigami, H., Sakai, S., Mori, C. (2008.0). Perinatal exposure to brominated flame retardants and polychlorinated biphenyls in Japan. Endocrine Journal 55(6):1071-1084.		
HERO ID:		1408306		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods for maternal blood, maternal milk, umbilical cords, and umbilical blood were described in detail.
	Metric 2:	Analytical Methodology	Medium	Some analytical methods were not reported such as recovery samples
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in human blood, milk, and tissues.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was conducted in Japan.
	Metric 5:	Currency	Medium	Samples were collected in 2005 and 2006.
	Metric 6:	Spatial and Temporal Variability	Medium	Samples were collected form 16 mothers without replicates.
	Metric 7:	Exposure Scenario	High	This is a biomonitoring study where exposure is presumed to occur via the widespread usage of brominated flame retardants.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	Low	QA/QC was not described.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variance was characterized with standard deviations, but there was no discussion of limitations and uncertainties.
Overall Quality Determination			Medium	

Study Citation:	Verslycke, T. A., Vethaak, A. D., Arijs, K., Janssen, C. R. (2005.0). Flame retardants, surfactants and organotins in sediment and mysid shrimp of the Scheldt estuary (The Netherlands). Environmental Pollution 136(1):19-31.			
HERO ID:	1417731			
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling Methodology	Medium	Sample storage duration not reported.
	Metric 2:	Analytical Methodology	Medium	Recovery samples and instrument calibration not reported.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media.
Domain 2: Representativeness	Metric 4:	Geographic Area	High	The Netherlands
	Metric 5:	Currency	Low	Samples were collected November 2001.
	Metric 6:	Spatial and Temporal Variability	Low	No replicates reported. Three Mysid samples collected and three sediment samples collected.
	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	Low	Recoveries and control samples not reported.
Domain 4: Variability and Uncertainty	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported.
Overall Quality Determination			Medium	

Study Citation:		Gerecke, A. C., Giger, W., Hartmann, P. C., Heeb, N. V., Kohler, H. P., Schmid, P., Zennegg, M., Kohler, M. (2006.0). Anaerobic degradation of brominated flame retardants in sewage sludge. Chemosphere 64(2):311-317.		
HERO ID:		1443845		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling equipment and methods are briefly described in relation to other samples collected for this study; it is unclear which details also apply to the "real-world" samples of interest, and these aspects may have a substantial impact on results.
	Metric 2:	Analytical Methodology	Low	Analytical instrumentation and methods are described in relation to other samples collected for this study; it is unclear which details also apply to the "real-world" samples of interest, and these aspects may have a substantial impact on results. Detection limits are not available either.
	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	Study was conducted in Switzerland.
	Metric 5:	Currency	Low	Samples were collected in 2003.
	Metric 6:	Spatial and Temporal Variability	Low	Single grab samples from the inlet, reactor, and outlet from one step of a wastewater treatment plant.
	Metric 7:	Exposure Scenario	Low	It is unclear if later steps in the wastewater treatment process might alter levels of the chemical of interest in the water prior to any likely exposure. There is also very little information about the WWTP itself.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data points were reported; no summary statistics were provided or useful for the three data points.
	Metric 9:	Quality Assurance	Medium	Recoveries were reported to be between 40-90%, and techniques were applied to correct for recovery.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Only one sample was analyzed for each stage of the wastewater treatment process, and so no characterization of variance could be reported. The differences between each concentration are discussed in the text, as well as uncertainties inherent to the data.
Overall Quality Determination			Low	

Study Citation:		Thomsen, C., Lundanes, E., Becher, G. (2002.0). Brominated flame retardants in archived serum samples from Norway: a study on temporal trends and the role of age. Environmental Science & Technology 36(7):1414-1418.		
HERO ID:		1443853		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
Metric 1:	Sampling Methodology	Low	Samples from serum bank archive. Minimal information on sample storage; samples stored at -20C for 27+ years. Samples from between 10 and 14 individuals were combined. All individuals were males between 40 and 50. Minimal information on study site, only described as "five different county hospitals." No information on sampling equipment or sampling procedure.	
Metric 2:	Analytical Methodology	Medium	Includes information on extraction, instrumentation, calibration, recovery, but LOQ is presented as a range. They did analyze samples from blanks.	
Metric 3:	Biomarker Selection	High	Measured parent compound in blood samples.	
Domain 2: Representativeness				
Metric 4:	Geographic Area	High	Norway	
Metric 5:	Currency	Low	Samples were collected from 1975 to 1999.	
Metric 6:	Spatial and Temporal Variability	Medium	Pooled serum samples over multiple points in time (6 different years) as well as pooled serum samples broken out by age (5 different age groups) and gender in one year. In all, the data were reported for 14 different pooled samples.	
Metric 7:	Exposure Scenario	Medium	Specific sources of exposure are unknown, but the data likely represent realistic, relevant exposure scenarios. There is a reference to the levels of PBDEs increasing in sediments, guillemot eggs, and pike since the 1960s, but this study did not measured TBBPA in the earliest samples, from 1977 and 1981. It's unclear if those early samples would constitute pre-exposure studies.	
Domain 3: Accessibility/Clarity				
Metric 8:	Reporting of Results	Medium	Raw data (the concentration in the pooled sample) were reported for each compound every year along with number of samples in each pooled sample, as well as the fat content of pooled sample. Summary statistics were missing.	
Metric 9:	Quality Assurance	Low	Recovery was below 70% for all reported chemicals (56, 69, and 25% for BDE-77, BB-77, and CtriBBP-A, but none for TBBPA was reported). Data were not corrected for low recovery.	
Domain 4: Variability and Uncertainty				
Metric 10:	Variability and Uncertainty	Low	There was no discussion of uncertainty, study limitations, or variance (and non standard deviation reported).	
Overall Quality Determination			Medium	

Study Citation:		Yang, S., Wang, S., Liu, H., Yan, Z. (2012.0). Tetrabromobisphenol A: tissue distribution in fish, and seasonal variation in water and sediment of Lake Chaohu, China. Environmental Science and Pollution Research 19(9):4090-4096.		
HERO ID:		1447752		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Authors sampled concentration in water, sediment, and fish (Fig 1 shows sampling sites). For water, 2L were collected from each site, filtered, and stored in 4C. For sediment, cores were collected by Beeker sampler, stored in plastic bags at 4C, ground, and sieved. Four species of fish had their tissues and organs collected, which were washed and sealed in plastic bags, ground before extraction
	Metric 2:	Analytical Methodology	High	Extraction methods were reported for all matrices (liquid-liquid for water, hexane/dichloromethane for sediment and fish). LC-MS/MS was the analytical method. Detection limits and recoveries were also provided.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in the environment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected from Lake Chaohu, eastern China.
	Metric 5:	Currency	Medium	Samples were collected during 2008-2009.
	Metric 6:	Spatial and Temporal Variability	Medium	Samples were collected form 10 sites - sediment from all sites, water from seven of them, and fish from just the center part of the lake. No replicates were reported.
	Metric 7:	Exposure Scenario	High	Exposure to contaminated surface water, sediment, and fish tissues in the main watershed and most developed regions in China is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Concentrations were illustrated in Figure 3-7. Numerical values are provided on pgs 4093-4095. No raw data were provided.
	Metric 9:	Quality Assurance	High	QA/QC protocols were reported, including mean recoveries of 98%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Only some characterization variance (i.e., ranges) were provided for some samples. Limitations were not discussed.
Overall Quality Determination			Medium	

Study Citation:		D'Hollander, W., Roosens, L., Covaci, A., Cornelis, C., Reynders, H., van Campenhout, K., de Voogt, P., Bervoets, L. (2010.0). Brominated flame retardants and perfluorinated compounds in indoor dust from homes and offices in Flanders, Belgium. Chemosphere 81(4):478-487.		
HERO ID:		1578505		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methods are stated to be in accordance with a standardized protocol published by other authors. The paper identifies that sampling locations were identified randomly, and it identifies the sampling equipment and procedures. However, the paper identifies a distinction between sock samples and vacuumed samples that is not well-explained. Sample storage conditions (temperature) and duration were not identified in this paper.
	Metric 2:	Analytical Methodology	High	Instrumentation analyses were detailed thoroughly, and the LOQ was provided.
	Metric 3:	Biomarker Selection	N/A	No biomarkers were used; they analyzed for the parent chemical in the environment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Flanders, Belgium
	Metric 5:	Currency	Medium	2008
	Metric 6:	Spatial and Temporal Variability	Medium	Dust samples came from 10 offices and 43 homes (note: the paper is inconsistent - the text mentions 43 homes and the table says n = 45 home samples). There were blind duplicates for 1 out of every 8 samples, but they sounded like technical replicates; since they did not actually collect replicate dust samples, I rated this as medium.
	Metric 7:	Exposure Scenario	High	Samples reflect a realistic/relevant exposure scenario. They also used a questionnaire to try to quantify potential sources of the chemicals found, which also provided some data on differences in microenvironments. They provided some exposure calculations for dust intake via ingestion for adults who spend part of their time in offices and part in homes, as well as non-working adults and toddlers in homes. However, these calculations were only for some of the chemicals and some chemical classes; the authors did not provide this type of calculation for TBBPA.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not provided. They provided 50th percentile and 95th percentile measurement of TBBPA in a table, and the summary states the range was <3 - 419 ng/g, with a median of 12. They did not provide the detection frequency or standard deviation.
	Metric 9:	Quality Assurance	High	QA/QC issues were discussed, and calibration curves and standards were used. Method recoveries ranged from 80-126% for brominated flame retardants. Mean blank values were subtracted. LOQ was set at 3 x SD of the procedural blank.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study says little about variability, uncertainty and limitations of the study itself. The study does make comparisons to results from other studies from similar geographic locations (the UK, US, and Canada) for general classes of chemicals, but not individual chemicals like TBBPA.
Overall Quality Determination			High	

Study Citation:		Gorga, M., Martínez, E., Ginebreda, A., Eljarrat, E., Barceló, D. (2013.0). Determination of PBDEs, HBB, PBEB, DBDPE, HBCD, TBBPA and related compounds in sewage sludge from Catalonia (Spain). Science of the Total Environment 444:51-59.		
HERO ID:		1676764		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methodology is only briefly discussed. Aside from a thorough discussion of site characteristics, most sampling information is missing.
	Metric 2:	Analytical Methodology	Medium	Analytical instrumentation and methods are described in sufficient detail, but certain details (e.g. instrument calibration) are not mentioned that are unlikely to impact results. LOD and LOQ are 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	Samples were collected from WWTFs in Spain.
	Metric 5:	Currency	Medium	Samples were collected in 2009.
	Metric 6:	Spatial and Temporal Variability	Medium	One sample was collected from 17 WWTPs without replicates.
	Metric 7:	Exposure Scenario	Medium	Exposure to TBBPA via wastewater discharge is relevant. However, it is unclear whether subsequent steps of the sewage treatment process might have affected concentration of the chemical of interest prior to any discharge to the environment and potential exposure.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data are reported alongside mean and median.
	Metric 9:	Quality Assurance	High	QA/QC measures included the use of blank samples, internal standards, and bias control. A recovery study was carried out in triplicate and determined recovery to be 98% for the chemical of interest.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Relative standard deviation was determined to be 9.5%, but only brief discussion of variability or uncertainty was reported.
Overall Quality Determination			Medium	

Study Citation:		Zhou, X., Guo, J., Lin, K., Huang, K., Deng, J. (2013.0). Leaching characteristics of heavy metals and brominated flame retardants from waste printed circuit boards. Journal of Hazardous Materials 246-247:96-102.		
HERO ID:		1789485		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods were described in sufficient detail for raw and treated landfill leachates. (Note that samples of waste printed circuit boards were also collected, but it was for an experimental study).
	Metric 2:	Analytical Methodology	High	Extraction procedures, analytical method (GC–NCI–MS), recoveries and LOD (4.50 ng/g) were all reported.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in the environment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Landfill samples were collected from the Laogang landfill, Shanghai, China.
	Metric 5:	Currency	Medium	Landfill leachates were collected in 2011. There is no reporting date for waste printed circuit boards, but that is not monitoring data.
	Metric 6:	Spatial and Temporal Variability	Medium	Waste printed circuit board samples were collected randomly from recycling facilities and dismantling work-shops, crushed, and pulverized into three particle size groups. Each particle size group had five samples, as did raw and treated landfill leachates. Replicates were not reported.
	Metric 7:	Exposure Scenario	High	Authors measured TBBPA leaching from waste printed circuit boards and its concentration in raw and treated leachate from the largest municipal waste landfill in Asia. Disposal is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 2 provides the mean and std deviation, but not raw data.
	Metric 9:	Quality Assurance	High	QA/QC techniques were sufficiently described, which including triplicate analysis, blanks, and recoveries ranging from 83.10-106.32.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	There was a limited discussion of gaps and uncertainties.
Overall Quality Determination			High	

Study Citation:	Chokwe, T. B., Okonkwo, J. O., Sibali, L. L., Ncube, E. J. (2012.0). Optimization and Simultaneous Determination of Alkyl Phenol Ethoxylates and Brominated Flame Retardants in Water after SPE and Heptafluorobutyric Anhydride Derivatization followed by GC/MS. Chromatographia 75(19-20):1165-1176.			
HERO ID:	1927538			
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology was briefly described. The volume of wastewater samples collected, from where in system, equipment, and storage temperatures were described.
	Metric 2:	Analytical Methodology	High	Authors described solid-phase extraction and GC-MS LOD. They also reported the detection limits in Table 6, as well as recoveries.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected from the Leeuwkuil WWTP, Vereeniging region, South Africa.
	Metric 5:	Currency	Low	The sampling date was not provided. The paper was published in 2012.
	Metric 6:	Spatial and Temporal Variability	Low	While the sample size was not provided, we can infer that at least three samples were collected (i.e., influent, effluent, and influent raw). Replicates were not reported.
	Metric 7:	Exposure Scenario	Medium	Exposure from wastewater discharge is relevant, but the setting/site characteristics were not described to determine potentially affected population or ecological systems.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Table 8 provides TBBPA concentration in effluent and influent samples. Because we are not know how many samples were collected, it is unclear if these results are raw data. No summary statistics were provided.
	Metric 9:	Quality Assurance	High	Table 5 provides recoveries that are acceptable. Blanks run and triplicate analysis was completed with each sample set.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	There is no characterization of variance or discussion of limitations and uncertainties.
Overall Quality Determination			Medium	

Study Citation:		Xu, J., Zhang, Y., Guo, C., He, Y., Li, L., Meng, W. (2013.0). Levels and distribution of tetrabromobisphenol A and hexabromocyclododecane in Taihu Lake, China. Environmental Toxicology and Chemistry 32(10):2249-2255.		
HERO ID:		1927542		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Concise but complete reporting of sampling methods
	Metric 2:	Analytical Methodology	High	Analytical methods were fully reported. LOQ provided in text.
	Metric 3:	Biomarker Selection	N/A	Study measured parent compound in surface water and sediment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected from Taihu Lake in China.
	Metric 5:	Currency	Medium	Sampling was done in 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	Samples were collected from 12 locations without replicates.
	Metric 7:	Exposure Scenario	High	Exposure to surface water or sediment by surrounding communities via drinking water, irrigation, or recreation is relevant. Study reported that the lake also serves an industrial use.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations were provided visually (i.e., no exact concentration data). Some summary statistics were provided in the text. More may be available in the supplemental.
	Metric 9:	Quality Assurance	High	Analyzed control samples, reported recoveries, and discussed instrument calibration
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variance reported in text as a range, but no discussion of uncertainties and study limitations was provided.
Overall Quality Determination			High	

Study Citation:		Lankova, D., Kockovska, M., Lacina, O., Kalachova, K., Pulkrabova, J., Hajslova, J. (2013.0). Rapid and simple method for determination of hexabromocyclododecanes and other LC-MS-MS-amenable brominated flame retardants in fish. Analytical and Bioanalytical Chemistry 405(24):7829-7839.		
HERO ID:		1927544		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some information missing such as how the fish were sampled and what parts of the fish were analyzed. More information may be given in the CONFIDENCE project which is referenced.
	Metric 2:	Analytical Methodology	High	Extraction and analytical methods, instrument, calibration reported. LOQ reported.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were obtained from Czech retail market.
	Metric 5:	Currency	Low	The collection date for the samples was not reported. Paper was published in 2013.
	Metric 6:	Spatial and Temporal Variability	Medium	A total of 37 samples were collected. No replicates were reported.
	Metric 7:	Exposure Scenario	Medium	Measuring for the chemical in fish which can be ingested. More information could be provided about exposed population.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Calibration plot was used to calculate concentrations (Fig S1). Raw data and summary statistics not reported.
	Metric 9:	Quality Assurance	High	Key QA was reported. Recoveries were over 70%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variation reported in the types of samples (species and area). Few gaps and limitations were reported.
Overall Quality Determination			Medium	

Study Citation:		Hloušková, V., Lanková, D., Kalachová, K., Hrádková, P., Poustka, J., Hajšlová, J., Pulkrabová, J. (2013.0). Occurrence of brominated flame retardants and perfluoroalkyl substances in fish from the Czech aquatic ecosystem. Science of the Total Environment 461-462:88-98.		
HERO ID:		1927549		
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	Czech Republic
	Metric 5:	Currency	Medium	Samples collected in 2010
	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			High	

Study Citation:		He, M. J., Luo, X. J., Yu, L. H., Wu, J. P., Chen, S. J., Mai, B. X. (2013.0). Diastereoisomer and enantiomer-specific profiles of hexabromocyclododecane and tetrabromobisphenol A in an aquatic environment in a highly industrialized area, South China: Vertical profile, phase partition, and bioaccumulation. Environmental Pollution 179:105-110.		
HERO ID:		1927551		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods (e.g., site description, equipment, storage) were reported. LOD/LOQ were not reported. Study measured parent chemical in environmental media.
	Metric 2:	Analytical Methodology	Low	
	Metric 3:	Biomarker Selection	N/A	
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in China.
	Metric 5:	Currency	Medium	Samples were collected in 2009.
	Metric 6:	Spatial and Temporal Variability	Medium	42 sediment samples were collected but without replicates.
	Metric 7:	Exposure Scenario	High	Exposure to TBBPA via sediment from nearby electronic and telecommunication equipment manufacturing is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	High	Relevant QA/QC techniques were reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Gaps and limitations were not reported.
Overall Quality Determination			Medium	

Study Citation:		Ni, H. G., Zeng, H. (2013.0). HBCD and TBBPA in particulate phase of indoor air in Shenzhen, China. Science of the Total Environment 458-460:15-19.		
HERO ID:		1927552		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Authors cited previously published work for details on their sampling protocol. Their summary in this paper was adequate.
	Metric 2:	Analytical Methodology	High	Analytical methods were sufficiently described. LOD was reported in text.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in indoor air of an office building.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in China.
	Metric 5:	Currency	Medium	Sampling was collected in 2009.
	Metric 6:	Spatial and Temporal Variability	Medium	56 samples were analyzed. No replicates were reported.
	Metric 7:	Exposure Scenario	High	Data closely represent relevant exposure scenarios (i.e., exposure via indoor air).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics and no raw data were reported.
	Metric 9:	Quality Assurance	Medium	QA/QC was discussed but recoveries reported only for HBCD and not TBBPA.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Table 1 characterized variability with min and max. Some uncertainties/limitations were discussed but only for the exposure estimation and not the monitoring data.
Overall Quality Determination			Medium	

Study Citation:		Shi, Z., Jiao, Y., Hu, Y., Sun, Z., Zhou, X., Feng, J., Li, J., Wu, Y. (2013.0). Levels of tetrabromobisphenol A, hexabromocyclododecanes and polybrominated diphenyl ethers in human milk from the general population in Beijing, China. Science of the Total Environment 452-453:10-18.		
HERO ID:		1927559		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling procedure, equipment, and storage reported. TheEthics Committee of Capital Medical University approved the study protocol.
	Metric 2:	Analytical Methodology	Medium	Some information missing such as calibration. LOD reported in supplementary.
	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 2011.
	Metric 6:	Spatial and Temporal Variability	Medium	103 samples. No replicates.
	Metric 7:	Exposure Scenario	High	Measuring the chemical in breast milk.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported. Summary statistics, including percentiles reported.
	Metric 9:	Quality Assurance	High	Key QA reported. High recoveries (75%-125%).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	No limitations reported. SD reported and analyzed variance. Compared results to other studies.
Overall Quality Determination			High	

Study Citation:		Carignan, C. C., Abdallah, M. A. E., Wu, N., Heiger-Bernays, W., McClean, M. D., Harrad, S., Webster, T. F. (2012.0). Predictors of tetrabromobisphenol-A (TBBP-A) and hexabromocyclododecanes (HBCD) in milk from Boston mothers. Environmental Science & Technology 46(21):12146-12153.		
HERO ID:		1927577		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods (e.g., study participants, collection methods, storage conditions, equipment) were reported. LOQ is reported in the main text, while LOD is in the supplemental.
	Metric 2:	Analytical Methodology	High	Key analytical methods (e.g., extraction methods, analytical methods, detection limits) were reported.
	Metric 3:	Biomarker Selection	High	This is a biomonitoring study but TBBPA does not have a biomarker.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Boston, MA
	Metric 5:	Currency	Medium	Samples were collected in 2004 and 2005.
	Metric 6:	Spatial and Temporal Variability	Medium	Breast milk samples were collected from 43 mothers without replicates.
	Metric 7:	Exposure Scenario	High	This is a biomonitoring study that described the various uses of TBBPA that can lead to exposure.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Summary statistics are provided in Table 1 and raw data in Table S5.
	Metric 9:	Quality Assurance	High	QA/QC methods included spiked samples, blanks, recoveries (acceptable), and other measures to assess accuracy and precision in the absence of standard reference material.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variance characterized with a range in Table 1. A few limitations were reported in the penultimate paragraph.
Overall Quality Determination			High	

Study Citation:		Hwang, I. K., Kang, H. H., Lee, I. S., Oh, J. E. (2012.0). Assessment of characteristic distribution of PCDD/Fs and BFRs in sludge generated at municipal and industrial wastewater treatment plants. Chemosphere 88(7):888-894.		
HERO ID:		1927598		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methods were not reported, other than stating they collected grab samples of sludge samples from wastewater treatment plants, then freeze-dried and sieved the samples.
	Metric 2:	Analytical Methodology	High	Key analytical methods were reported, including extraction method, analytical instrumentation, and calibration. The LOQ was reported.
	Metric 3:	Biomarker Selection	N/A	They analyzed the chemical of interest in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	South Korea
	Metric 5:	Currency	Medium	The study was published in 2012, but the year of sampling was not specified.
	Metric 6:	Spatial and Temporal Variability	Medium	There were 11 samples, but no replicates.
	Metric 7:	Exposure Scenario	Medium	There were no controls and no information about potential sources of the chemical. Also, climate information was not supplied. However, the data could represent a relevant exposure scenario, with no reason for there to be lower confidence in the scenario assessed.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Maximum, minimum, and raw data were reported. No other summary statistics were reported.
	Metric 9:	Quality Assurance	Low	Use of a standard and determination of a calibration curve and recoveries were reported. However, the recovery for this chemical was 56% - 117%, and they did not correct for recovery, so I gave this a low score. They also did not analyze blank samples.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	There is a brief discussion of variability between samples from industrial sewage plants and those from municipal wastewater treatment plants. There was no discussion of uncertainty, and few gaps and limitations were reported.
Overall Quality Determination			Medium	

Study Citation:		Feng, A. H., Chen, S. J., Chen, M. Y., He, M. J., Luo, X. J., Mai, B. X. (2012.0). Hexabromocyclododecane (HBCD) and tetrabromobisphenol A (TBBPA) in riverine and estuarine sediments of the Pearl River Delta in southern China, with emphasis on spatial variability in diastereoisomer- and enantiomer-specific distribution of HBCD. Marine Pollution Bulletin 64(5):919-925.		
HERO ID:		1927606		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Methodology to collect grab surface sediment samples was described in full.
	Metric 2:	Analytical Methodology	High	Key analytical methods (e.g., extraction, instrumentation, LODs). were 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 China.
	Metric 5:	Currency	Medium	Samples were collected in 2009 and 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	About 100 surface sediment samples and two sewage sludge samples were collected. Replicates were not reported.
	Metric 7:	Exposure Scenario	Medium	The Pearl River Delta is an important manufacturing area, including for electronics, that contributes to TBBPA contamination. Exposure to TBBPA in river sediment is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data are available in Table S1. Table 1 of main paper summarizes range, mean, and median by river.
	Metric 9:	Quality Assurance	Low	QA/QC protocol was reported, but the mean recoveries of TBBPA in both spiked blanks and matrices were 55%. Authors did not report about if/how they corrected for them.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No gaps and limitations were reported.
Overall Quality Determination			Medium	

Study Citation:		He, M. J., Luo, X. J., Yu, L. H., Liu, J., Zhang, X. L., Chen, S. J., Chen, D., Mai, B. X. (2010.0). Tetrabromobisphenol-A and hexabromocyclododecane in birds from an e-waste region in South China: Influence of diet on diastereoisomer- and enantiomer-specific distribution and trophodynamics. Environmental Science & Technology 44(15):5748-5754.		
HERO ID:		1927673		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Authors collected samples from multiple species and media. Birds came from different habitats and feeding habits; TBBPA was examined in their muscles and diet and were dead or dying at the time of sampling. Wild fish was collected from abolished pools using electric fishing devices. Grain samples came from rice fields mixed into 3 composite samples. Three composite leaf samples were collected from eucalyptus, three water samples from fish pools, and four soil samples. Tissues of birds were stored at -20C.Sampling methods for each media or species were a bit limited.
	Metric 2:	Analytical Methodology	High	For bird samples, a description of extraction and analytical methods is complete. For water, grain, plant leaf, and soil samples, analytical methods is described but only a reference to previously published extraction protocol is provided. This is unlikely to affect results though.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was performed in Qingyuan, South China.
	Metric 5:	Currency	Medium	Sample collected occurred during 2005-2008.
	Metric 6:	Spatial and Temporal Variability	Medium	The total number of samples is 40, but there were only 6 from bird species, 7 from fish, 3 from water, 3 from grain, 3 from plants, and 4 from soil. No replicates were provided. Medium score is given based on the highest number of samples for a single scenario.
	Metric 7:	Exposure Scenario	High	Measuring concentrations in bird muscle and habitat and feeding habits from second largest e-waste recycling region in Pearl River Delta is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1 provided mean and range in media per bird species and media type. No raw data were available.
	Metric 9:	Quality Assurance	High	QA/QC was reported including procedural and spiking blanks, as well as recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	There is no discussion of limitations or uncertainties.
Overall Quality Determination			Medium	

Study Citation:		Mascolo, G., Locaputo, V., Mininni, G. (2010.0). New perspective on the determination of flame retardants in sewage sludge by using ultrahigh pressure liquid chromatography-tandem mass spectrometry with different ion sources. Journal of Chromatography A 1217(27):4601-4611.		
HERO ID:		1927680		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
Metric 1:	Sampling Methodology	Low	The only pertinent sampling information that was reported is the number of municipal treatment plants (n=7), type of sludge samples (secondary and digested), and sampling frequency (2 times per day for 5 days to achieve a representative sample). No other information, such as treatment plant characteristics, equipment, or storage were discussed.	
Metric 2:	Analytical Methodology	High	All pertinent information was reported (e.g., pressurized liquid extraction, UPLC–MS/MS for analysis, LOD and LOQ in Table 2 and recoveries).	
Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in sewage sludge.	
Domain 2: Representativeness				
Metric 4:	Geographic Area	High	Samples were collected in Apulia region, Italy.	
Metric 5:	Currency	Low	No sampling date was provided. Paper was published in 2010.	
Metric 6:	Spatial and Temporal Variability	Medium	Seven WWTPs were sampled for twice a day for five consecutive days to achieve one representative sample per plant. No replicate samples were reported.	
Metric 7:	Exposure Scenario	Medium	Setting and characteristics of WWTPs were not described, thus it is unclear what are the potentially affected populations.	
Domain 3: Accessibility/Clarity				
Metric 8:	Reporting of Results	Medium	Table 4 provides individual concentration per plant in digested-dewatered sludge and secondary excess sludge. No summary statistics were provided, but they can be calculated with the raw data.	
Metric 9:	Quality Assurance	Low	QA/QC specific to sampling of WWTP sludge was not discussed but can be implied by earlier method discussion. Recoveries ranged from 65-112%	
Domain 4: Variability and Uncertainty				
Metric 10:	Variability and Uncertainty	Low	No variance or uncertainties were discussed.	
Overall Quality Determination			Medium	

Study Citation:		Mchugh, B., Poole, R., Corcoran, J., Anninou, P., Boyle, B., Joyce, E., Barry Foley, M., McGovern, E. (2010.0). The occurrence of persistent chlorinated and brominated organic contaminants in the European eel (<i>Anguilla anguilla</i>) in Irish waters. Chemosphere 79(3):305-313.		
HERO ID:		1927686		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods, equipment, storage detailed.
	Metric 2:	Analytical Methodology	Medium	Analytical extraction and methods, instrument, detection limits reported. Missing some information such as calibration.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in biota.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Ireland
	Metric 5:	Currency	Medium	Samples collected in 2005.
	Metric 6:	Spatial and Temporal Variability	Medium	76 samples. No replicates.
	Metric 7:	Exposure Scenario	Medium	Measuring chemical in glass eels.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data and summary statistics not reported, although all reported as non detect.
	Metric 9:	Quality Assurance	Low	QA reported but recoveries for TBBPA low (25% to 50%).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variation in different areas sampled. No limitations reported.
Overall Quality Determination			Medium	

Study Citation:		Harrad, S., Abdallah, M. A. E., Rose, N. L., Turner, S. D., Davidson, T. A. (2009.0). Current-use brominated flame retardants in water, sediment, and fish from English lakes. Environmental Science & Technology 43(24):9077-9083.		
HERO ID:		1927694		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling sites and methodology for water, sediment, and fish discussed in Methods section (p.9076). Sampling equipment, procedure, and storage discussed. Water was filtered. Site details given in supplemental.
	Metric 2:	Analytical Methodology	Medium	Analytical and extraction methods, procedure, and instruments reported (Soxhlet extract; LC-MS/MS). Some information missing such as calibration. Method validation provided in SI. LOQ reported.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	England (Figure 1)
	Metric 5:	Currency	Medium	July 2008-January 2009
	Metric 6:	Spatial and Temporal Variability	High	Water (n =27) sampled summer, autumn, and winter. Sediment (n=9) sampled same time as water (7 cores homogenized into one sample per site). Fish samples (n=30) collected in summer from nine English lakes. 5 replicates were analysed for sediment samples and 7 replicates for fish samples.
	Metric 7:	Exposure Scenario	Medium	Surface water, sediment, and fish taken from lakes across England. More detail per location provided in Table S1. No major point source inputs to any of the lakes.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1 provides average concentration in water per lake. Table 2 provides sediment concentration per lake. Table 3 provides concentration per fish. Some summary statistics given, such as SD for water and range for fish.
	Metric 9:	Quality Assurance	High	Details of Method Validation and QA/QC Procedures in SI. High recoveries (over 70%).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Discusses seasonal and spatial variation per media. No limitations reported.
Overall Quality Determination			High	

Study Citation:		Shi, Z. X., Wu, Y. N., Li, J. G., Zhao, Y. F., Feng, J. F. (2009.0). Dietary exposure assessment of Chinese adults and nursing infants to tetrabromobisphenol-A and hexabromocyclododecanes: Occurrence measurements in foods and human milk. Environmental Science & Technology 43(12):4314-4319.		
HERO ID:		1927708		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Most information reported except details of food and store obtained from. Missing information on equipment used for breast milk collection.
	Metric 2:	Analytical Methodology	Medium	Extraction and analytical methods, equipment, and LODs for the different food groups and breast milk reported. Some information such as calibration not reported.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in food and breast milk.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	Medium	Samples collected in 2007
	Metric 6:	Spatial and Temporal Variability	Medium	662 food items and 1237 breast milk samples. No replicates.
	Metric 7:	Exposure Scenario	High	Measured samples from breast milk. Used survey to determine food groups to analyze.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data not reported. Only means reported for each location and food group/breastmilk.
	Metric 9:	Quality Assurance	High	Key QA reported. Method and procedural blanks performed. Recoveries over 70%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variation measured in different food types of locations. No limitations reported.
Overall Quality Determination			Medium	

Study Citation:		Law, R. J., Bersuder, P., Barry, J., Wilford, B. H., Allchin, C. R., Jepson, P. D. (2008.0). A significant downturn in levels of hexabromocyclododecane in the blubber of harbor porpoises (<i>Phocoena phocoena</i>) stranded or bycaught in the UK: an update to 2006. <i>Environmental Science & Technology</i> 42(24):9104-9109.		
HERO ID:		1927721		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The porpoises sampled were collected within the Cetacean Strandings Investigation Program funded by the U.K. government. Sampling methods are discussed in an external reference in moderate detail, but certain aspects (e.g. duration of storage) were absent that are unlikely to have a substantial impact on results.
	Metric 2:	Analytical Methodology	High	Extraction and analytical instrumentation and methods are reported in sufficient detail, although more information can be found in the cited reference. LOQ and LOD are reported.
	Metric 3:	Biomarker Selection	N/A	This study is testing for the parent chemical of interest in porpoises.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	United Kingdom
	Metric 5:	Currency	Medium	2003-2006
	Metric 6:	Spatial and Temporal Variability	Medium	Blubber samples from 138 porpoises. Sampling description does not mention the use of replicates.
	Metric 7:	Exposure Scenario	Medium	Measuring chemicals in porpoises, however, there is little discussion of possible exposure sources.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Because all samples were below the LOD, neither raw data nor summary statistics could be provided.
	Metric 9:	Quality Assurance	High	QA/QC methods included laboratory reference materials and duplicate analytical samples, and recoveries were found to be within acceptable ranges (>70%).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Because all samples were below the LOD, no characterization of variability could be reported. Some limitations/sources of uncertainty are discussed, although these are primarily in reference to the other analytes in the study. There is comparison of results to other studies.
Overall Quality Determination			High	

Study Citation:		Takigami, H., Suzuki, G., Hirai, Y., Sakai, S. (2008.0). Transfer of brominated flame retardants from components into dust inside television cabinets. Chemosphere 73(2):161-169.		
HERO ID:		1927735		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methods were reported except storage conditions. It is unclear if samples were stored at all prior to preparation. Sampler calibration was not reported but not applicable either.
	Metric 2:	Analytical Methodology	Low	Analytical methods were adequately described, but LOD/LOQs were not reported. Table S1 that supposedly presents detection limits did not include TBBPA.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical transferred from TV components into dust.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were obtained from Japan.
	Metric 5:	Currency	Low	TV sets where samples were collected from, were in use until 2005. However, it is unclear if samples were collected during the same year.
	Metric 6:	Spatial and Temporal Variability	Medium	Four samples each from five TV sets were collected without replicates.
	Metric 7:	Exposure Scenario	High	Release of TBBPA from TV sets into dust is a relevant exposure pathway.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No summary statistics were provided but can be calculated from raw data in Table 3.
	Metric 9:	Quality Assurance	High	QA/QC were reported, including the adherence to established laboratory protocols and acceptable recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Gaps and limitations were not reported.
Overall Quality Determination			Medium	

Study Citation:		van Leeuwen, S. P., de Boer, J. (2008.0). Brominated flame retardants in fish and shellfish - Levels and contribution of fish consumption to dietary exposure of Dutch citizens to HBCD. Molecular Nutrition and Food Research 52(2):194-203.		
HERO ID:		1927756		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Fish was mostly sampled during surveys of the research vessel Tridens. Remaining samples were obtained directly from anglers, from the auction, or from wholesale traders (farmed fish). Eel was caught by electric fishery.
	Metric 2:	Analytical Methodology	Medium	Recovery and LODs were not reported.
	Metric 3:	Biomarker Selection	N/A	Parent chemical was measured in environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Netherlands.
	Metric 5:	Currency	Low	Samples were collected in 2003.
	Metric 6:	Spatial and Temporal Variability	High	More than 10 samples were collected.
	Metric 7:	Exposure Scenario	Medium	Exposure source was not well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data was not reported.
	Metric 9:	Quality Assurance	High	Key QA/QC were reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations were reported.
Overall Quality Determination			Medium	

Study Citation:		Fernandes, A., Dicks, P., Mortimer, D., Gem, M., Smith, F., Driffield, M., White, S., Rose, M. (2008.0). Brominated and chlorinated dioxins, PCBs and brominated flame retardants in Scottish shellfish: Methodology, occurrence and human dietary exposure. Molecular Nutrition and Food Research 52(2):238-249.		
HERO ID:		1927760		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methods were not reported such as sample storage conditions or equipment.
	Metric 2:	Analytical Methodology	Medium	Most analytical methods reported. However, it's unclear if the LOD is 0.01 ug/kg for TBBPA in all shellfish species analyzed or varies by species (pg 7).
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in shellfish.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Scotland.
	Metric 5:	Currency	Medium	Samples were collected in 2006.
	Metric 6:	Spatial and Temporal Variability	Medium	Replicates were not reported. There were 35 composite analytical samples.
	Metric 7:	Exposure Scenario	High	Possible exposure to TBBPA via shellfish, which can bioaccumulate contaminants that diffuse out of materials into the environment, is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data were reported to the extent that TBBPA was not detectable in any of the samples.
	Metric 9:	Quality Assurance	Medium	Some QC methods were reported, such as duplicate analysis and method blank. Overall, this section is not robust enough.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Gaps and limitations were not reported.
Overall Quality Determination			Medium	

Study Citation:		Johnson-Restrepo, B., Adams, D. H., Kannan, K. (2008.0). Tetrabromobisphenol A (TBBPA) and hexabromocyclododecanes (HBCDs) in tissues of humans, dolphins, and sharks from the United States. Chemosphere 70(11):1935-1944.		
HERO ID:		1927767		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Most methods reported except for information about how samples from bottlenose dolphins and sharks were collected.
	Metric 2:	Analytical Methodology	High	Analytical methods were reported, including references to previously reported protocols that were followed and the modifications.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in humans and biota.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in the USA.
	Metric 5:	Currency	Low	Samples were collected between 1991 and 2004.
	Metric 6:	Spatial and Temporal Variability	Medium	20 human tissue samples and 31 samples from dolphins and sharks. No replicates were reported.
	Metric 7:	Exposure Scenario	High	Exposure to aquatic species and humans is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	Medium	QA/QC reported, but recoveries reported in Table 1 for TBBPA was <70% for all sample matrices except bottlenose dolphins.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Gaps and limitations were not reported.
Overall Quality Determination			Medium	

Study Citation:		Saito, I., Onuki, A., Seto, H. (2007.0). Indoor organophosphate and polybrominated flame retardants in Tokyo. Indoor Air 17(1):28-36.		
HERO ID:		1927779		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The description of sampling methods is limited.
	Metric 2:	Analytical Methodology	Medium	Analytical methods are described with no mention of instrument calibration
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Tokyo, Japan.
	Metric 5:	Currency	Low	Sampling took place in 2002.
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates were reported.
	Metric 7:	Exposure Scenario	Medium	Did not measure air ventilation rates during sampling periods.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No individual data points reported. Summary statistics were reported.
	Metric 9:	Quality Assurance	High	Some QA/QC discussed with no major issues identified.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited characterization of variability; provided range.
Overall Quality Determination			Medium	

Study Citation:		Suzuki, S., Hasegawa, A. (2006.0). Determination of hexabromocyclododecane diastereoisomers and tetrabromobisphenol A in water and sediment by liquid chromatography/mass spectrometry. Analytical Sciences 22(3):469-474.		
HERO ID:		1927792		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling Methodology	Low	landfill leachates and sediment from 5 industrial waste landfill sites and marine sediment were measured; Samples A to D and F were the influents to five water treatment plants in five landfill sites, and sample E was the treated effluent from D; no further sampling details provided
	Metric 2:	Analytical Methodology	High	SPE and/or solvent extraction; LC/MS and LC/MS/MS; LOD=0.2 ng/L; recoveries
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in landfill leachates and sediments.
Domain 2: Representativeness	Metric 4:	Geographic Area	Critically Deficient	no mention of location of landfills; based on author and funding assume Japan, but not mentioned in text of document
	Metric 5:	Currency	Low	2004
	Metric 6:	Spatial and Temporal Variability	Low	6 landfill leachate and sediment samples sampled in April; 1 marine sediment site; sample size per site not reported; may be single sample per site
	Metric 7:	Exposure Scenario	High	industrial waste landfill sites - leachate and sediment
Domain 3: Accessibility/Clarity	Metric 8:	Reporting of Results	Medium	Table 2 provides concentration per site
	Metric 9:	Quality Assurance	Medium	recovery efficiencies for the method deployed provided in Table 1, exceeding 85%
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	mentions that concentrations were lower compared to previous published data
Overall Quality Determination		Uninformative		

Study Citation:		Law, R. J., Bersuder, P., Allchin, C. R., Barry, J. (2006.0). Levels of the flame retardants hexabromocyclododecane and tetrabromobisphenol A in the blubber of harbor porpoises (Phocoena phocoena) stranded or bycaught in the U.K., with evidence for an increase in HBCD concentrations in recent years. Environmental Science & Technology 40(7):2177-2183.		
HERO ID:		1927795		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methods are discussed in an external reference in moderate 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	Medium	Analytical instrumentation and methods are reported in sufficient detail. LOQ was calculated for each sample, and any samples that were below LOQ were reported as being below the specific value (e.g. <5, <10, etc.). However, the precise LOQs were ultimately not provided.
	Metric 3:	Biomarker Selection	N/A	This study is testing for the parent chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in the United Kingdom.
	Metric 5:	Currency	Low	Samples were collected during 1994-2003.
	Metric 6:	Spatial and Temporal Variability	Medium	Blubber samples from 68 porpoises; sampling description does not mention the use of replicates
	Metric 7:	Exposure Scenario	Medium	There is little discussion of possible exposure sources, but detection of TBBPA in porpoises indicates exposure among marine species.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data are reported. Summary statistics are not tabulated; text only describes the number of samples above LOQ and the maximum concentration.
	Metric 9:	Quality Assurance	Medium	QA/QC methods included the use of internal standards and duplicate analytical samples; however, the samples that were duplicated were either below LOQ for the chemical of interest or not assessed for the chemical of interest.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No characterization of variability was reported, and discussion of limitations or sources of uncertainty are primarily focused on analytes other than the chemical of interest.
Overall Quality Determination			Medium	

Study Citation:		Vorkamp, K., Thomsen, M., Falk, K., Leslie, H., Møller, S., Sørensen, P. B. (2005.0). Temporal development of brominated flame retardants in peregrine Falcon (Falco peregrinus) eggs from South Greenland (1986-2003). Environmental Science & Technology 39(21):8199-8206.		
HERO ID:		1927805		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Pertinent sampling methods were described.
	Metric 2:	Analytical Methodology	Low	Detection limits for TBBPA may be in Table S2 as authors reported that TBBPA was not detected in all eggs. However, it is unclear why the detection limit varied between eggs.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in bird eggs.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Eggs were collected in Greenland.
	Metric 5:	Currency	Low	Samples were collected between 1986 and 2003.
	Metric 6:	Spatial and Temporal Variability	Medium	There were 33 eggs analyzed for TBBPA or dimethyl-TBBPA without replicates.
	Metric 7:	Exposure Scenario	High	Measuring TBBPA concentrations in a top predator is relevant to how the widespread exposure to TBBPA can occur in the food chain.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Some quantitative summary statistics are reported on paragraph 4 of page 4, but they are for dimethyl TBBPA. Raw data are available in Table S2.
	Metric 9:	Quality Assurance	High	Key QA reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Very few gaps and limitations were reported.
Overall Quality Determination			Medium	

Study Citation:		Cariou, R., Antignac, J. P., Marchand, P., Berrebi, A., Zalko, D., Andre, F., Le Bizec, B. (2005.0). New multiresidue analytical method dedicated to trace level measurement of brominated flame retardants in human biological matrices. Journal of Chromatography A 1100(2):144-152.		
HERO ID:		1927807		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Samples were from other studies, not primary samples. Some sampling methodology information not reported, but unlikely to have substantial impact on results.
	Metric 2:	Analytical Methodology	High	New analytical method but discussed in details and appropriate. Key elements such as LOD/LOQ, instrumentation, extraction method were reported.
	Metric 3:	Biomarker Selection	High	TBBPA directly measured in samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	France
	Metric 5:	Currency	Low	Sampling date not available, study published in 2005.
	Metric 6:	Spatial and Temporal Variability	Medium	Replicate samples were not applied. More than 10 breast milk samples used.
	Metric 7:	Exposure Scenario	Low	Exposure scenario not reported.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data not provided; Many summary statistics not reported.
	Metric 9:	Quality Assurance	High	Quality assurance information provided and discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limitation and difficulty due to contamination were discussed; unlikely to have substantial impact to the results.
Overall Quality Determination			Medium	

Study Citation:		Herzke, D., Berger, U., Kallenborn, R., Nygård, T., Vetter, W. (2005.0). Brominated flame retardants and other organobromines in Norwegian predatory bird eggs. Chemosphere 61(3):441-449.		
HERO ID:		1927808		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Most sampling methods (e.g., site characteristics, storage conditions) were reported. There was no description or reference to how egg contents were removed prior to storage for analysis.
	Metric 2:	Analytical Methodology	High	Key analytical methods were reported. MDL and LOQ provided in text on pg 4.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in bird eggs.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected from Norway.
	Metric 5:	Currency	Low	Samples were collected from 1991 to 2002.
	Metric 6:	Spatial and Temporal Variability	Medium	62 eggs were collected from 6 different bird species without replicates.
	Metric 7:	Exposure Scenario	High	Measurement of TBBPA in birds is relevant given its insight into the chemical's bioaccumulation in different food chains.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Data for TBBPA are only discussed in Section 3.3 (pg 7). Authors noted the range detected in the eggs, but did not tabulate nor graph the data.
	Metric 9:	Quality Assurance	Low	Very little QA/QC methods were reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Gaps and limitations were not reported.
Overall Quality Determination			Medium	

Study Citation:		Morris, S., Allchin, C. R., Zegers, B. N., Haftka, J. J., Boon, J. P., Belpaire, C., Leonards, P. E., Van Leeuwen, S. P., De Boer, J. (2004.0). Distribution and fate of HBCD and TBBPA brominated flame retardants in North Sea estuaries and aquatic food webs. Environmental Science & Technology 38(21):5497-5504.		
HERO ID:		1927817		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methods described for each type of sample. Sites described and additional information provided in SI. Some sampling methods not reported such as sample storage conditions.
	Metric 2:	Analytical Methodology	High	Extraction and analytical methods, calibration standards, instrumentation, recovery samples, and LOD reported.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media and biota.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	North Sea Estuaries
	Metric 5:	Currency	Low	Samples collected in 1999-2002 (depending on the sample type).
	Metric 6:	Spatial and Temporal Variability	Medium	Some sample types and locations less than 10. No replicates.
	Metric 7:	Exposure Scenario	High	Collected samples from various biota and sediments. There is also sampling of sewage sludge and landfill leachates.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported. Summary statistics such as mean, SD, and range reported.
	Metric 9:	Quality Assurance	Medium	Limited QA reported but can be inferred from the study’s protocols. Recoveries not reported for TBBPA.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variation in the sampling media and locations. No limitations reported.
Overall Quality Determination			Medium	

Study Citation:		Abdallah, M. A. E., Harrad, S. (2010.0). Modification and calibration of a passive air sampler for monitoring vapor and particulate phase brominated flame retardants in indoor air: Application to car interiors. Environmental Science & Technology 44(8):3059-3065.		
HERO ID:		1927993		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Detailed sampling methods, equipment (active and passive sampler), calibration, storage, and types of vehicles studied.
	Metric 2:	Analytical Methodology	High	Extraction and analytical methods, recovery samples, and instrument, LOD reported. Additional information referenced.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Vehicle studied from UK.
	Metric 5:	Currency	Medium	Sampling in 2008 and 2009
	Metric 6:	Spatial and Temporal Variability	Medium	21 vehicles sampled. Two samplers were deployed in 18 cars; one in the trunk and the other in the cabin. No replicates.
	Metric 7:	Exposure Scenario	High	Measuring the chemical in indoor air of vehicles.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Individual data in SI. Average and SD reported as summary statistics.
	Metric 9:	Quality Assurance	High	QA/QC reported in SI. Recoveries over 70%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability in the locations of the vehicle sampled (trunk vs cabin) and time (for 45 days). SD was also reported. There was no discussion of limitations.
Overall Quality Determination			High	

Study Citation:		Kopp, E. K., Fromme, H., Voelkel, W. (2012.0). Analysis of common and emerging brominated flame retardants in house dust using ultrasonic assisted solvent extraction and on-line sample preparation via column switching with liquid chromatography-mass spectrometry. Journal of Chromatography A 1241:28-36.		
HERO ID:		1928011		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some information missing such as Vibratory Sieve Shaker AS 200 calibration.
	Metric 2:	Analytical Methodology	High	Extraction and analytical, instrument, calibration curves, recovery samples, LOQ reported.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Germany
	Metric 5:	Currency	Low	Study published in 2012 but no date of sample collection reported.
	Metric 6:	Spatial and Temporal Variability	Medium	5 samples. No replicates.
	Metric 7:	Exposure Scenario	High	Indoor dust samples from households.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported. Summary statistics such as mean and range reported.
	Metric 9:	Quality Assurance	High	Key QA reported such as method validation and performance. High recoveries (all >70%).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some limitations about the different analytical techniques detailed. No discussion of variance.
Overall Quality Determination			Medium	

Study Citation:		Geens, T., Roosens, L., Neels, H., Covaci, A. (2009.0). Assessment of human exposure to Bisphenol-A, Triclosan and Tetrabromobisphenol-A through indoor dust intake in Belgium. Chemosphere 76(6):755-760.		
HERO ID:		2095186		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Well described, scientifically sound methodology
	Metric 2:	Analytical Methodology	High	Detailed analytical methods, reported LOD
	Metric 3:	Biomarker Selection	N/A	Did not test biomarkers
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Belgium
	Metric 5:	Currency	Medium	Sampled in 2008
	Metric 6:	Spatial and Temporal Variability	Medium	20 samples, no replicates
	Metric 7:	Exposure Scenario	High	Data closely represents relevant exposure scenarios
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics
	Metric 9:	Quality Assurance	Medium	Detailed QA/QC techniques, internal standards used but recoveries were not reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited characterization of variability, no description of limitations and uncertainties
Overall Quality Determination			High	

Study Citation:		Fujii, Y., Harada, K. H., Hitomi, T., Kobayashi, H., Koizumi, A., Haraguchi, K. (2014.0). Temporal trend and age-dependent serum concentration of phenolic organohalogen contaminants in Japanese men during 1989-2010. Environmental Pollution 185:228-233.		
HERO ID:		2149393		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	They did not report sampling procedures/equipment, but they used serum samples from a university serum bank and reported the way the samples were stored. Some samples used were stored for almost 25 years at -20C.
	Metric 2:	Analytical Methodology	High	The study reported the extraction method, instrumentation, calibration, and recovery, as well as the LOQ.
	Metric 3:	Biomarker Selection	High	TBBPA was measured in human blood.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Japan
	Metric 5:	Currency	Medium	Samples were collected from 1989 to 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	Each pooled sample contained blood from 10 volunteers. Samples were from three different years. In each year, there was a pool from individuals in their 20s and another from individuals over 50. There were no replicates.
	Metric 7:	Exposure Scenario	Medium	Data likely represent a realistic and relevant scenario, but sources of exposures were not well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported. They reported detection frequency and mean results. They also reported another set of data in parentheses, which represents the range (based on how some of the same data are described in the text - the table doesn't indicate that this set of numbers is a range).
	Metric 9:	Quality Assurance	High	There was a robust discussion of QA/QC, including use of blanks and recoveries. There were no pre-exposure samples possible.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	While there is a bit of discussion about variability, there is no discussion of uncertainty or limitations, other than the small sample size.
Overall Quality Determination			High	

Study Citation:		Almqvist, H., Hanaeus, J. (2006.0). Organic hazardous substances in graywater from Swedish households. Journal of Environmental Engineering 132(8):901-908.		
HERO ID:		2151800		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	site description and sampling described
	Metric 2:	Analytical Methodology	Low	Accredited contract laboratory conducted analyses, no LOD
	Metric 3:	Biomarker Selection	N/A	environmental samples
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Sweden
	Metric 5:	Currency	Low	2001
	Metric 6:	Spatial and Temporal Variability	Low	n = 3
	Metric 7:	Exposure Scenario	Low	graywater
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	range and average provided
	Metric 9:	Quality Assurance	Low	QA not discussed, no obvious concerns
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	variability and uncertainty not discussed, no obvious concerns
Overall Quality Determination			Low	

Study Citation:		Ashizuka, Y.,uk, Nakagawa, R., Hori, T., Yasutake, D., Tobiishi, K., Sasaki, K. (2008.0). Determination of brominated flame retardants and brominated dioxins in fish collected from three regions of Japan. Molecular Nutrition and Food Research 52(2):273-283.		
HERO ID:		2152581		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some methods not reported such as sampling equipment or storage duration.
	Metric 2:	Analytical Methodology	Medium	Analytical methods were well described but missing reports of recovery.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in fish.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Japan.
	Metric 5:	Currency	Medium	Samples were collected between 2004 and 2005.
	Metric 6:	Spatial and Temporal Variability	Medium	45 samples were collected without replicates.
	Metric 7:	Exposure Scenario	High	Detection of TBBPA in fish is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Mean and raw data were reported in Table 5.
	Metric 9:	Quality Assurance	Medium	Limited QA (primarily just spiked sample) was reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Gaps and limitations were not reported.
Overall Quality Determination			Medium	

Study Citation:		Berger, U., Herzke, D., Sandanger, T. M. (2004.0). Two trace analytical methods for determination of hydroxylated PCBs and other halogenated phenolic compounds in eggs from Norwegian birds of prey. Analytical Chemistry 76(2):441-452.		
HERO ID:		2153883		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	predatory bird eggs supplied by the Norwegian Institute for Nature Research; describe which eggs were used and processing methods
	Metric 2:	Analytical Methodology	High	detailed description of various analytical methods including GC/HRMS, GC/LRMS, and HPLC/TOF-MS Analysis; provide LOQ
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Norway
	Metric 5:	Currency	Low	samples collected between 1994-2000; paper published in 2004
	Metric 6:	Spatial and Temporal Variability	Medium	8 samples
	Metric 7:	Exposure Scenario	Medium	phenolic compounds (TBBPA) in bird of prey eggs
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	provide concentration for each sample but no summary stats or measures of variance
	Metric 9:	Quality Assurance	Medium	recovery rates not all >75% (between 56-98% and 57-108%); used a blank control
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	discuss some uncertainty/limitations briefly but didn't measure variance
Overall Quality Determination			Medium	

Study Citation:		Cariou, R., Antignac, J. P., Zalko, D., Berrebi, A., Cravedi, J. P., Maume, D., Marchand, P., Monteau, F., Riu, A., Andre, F., Le Bizec, B. (2008.0). Exposure assessment of French women and their newborns to tetrabromobisphenol-A: Occurrence measurements in maternal adipose tissue, serum, breast milk and cord serum. Chemosphere 73(7):1036-1041.		
HERO ID:		2156366		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some methods not reported such as sample storage conditions.
	Metric 2:	Analytical Methodology	Low	Some information such as instrument calibration and recovery samples not reported. LOQ not reported.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in adipose tissue, breast milk, maternal serum, and cord serum.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	France
	Metric 5:	Currency	Medium	Samples collected between 2004 and 2006.
	Metric 6:	Spatial and Temporal Variability	Medium	44 adipose tissue, 77 breast milk, 91 maternal serum, 90 cord serum. No replicates.
	Metric 7:	Exposure Scenario	High	Measuring chemical exposure to women and their newborns.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data and mean, median, min, max, SD reported for each type of sample.
	Metric 9:	Quality Assurance	Medium	Some QA reported, including a procedural blank and a reference sample per matrix type were added in each 10 sample batch. No recoveries reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability studied in types of samples. No limitations reported.
Overall Quality Determination			Medium	

Study Citation:		Thomsen, C., Liane, V. H., Becher, G. (2007.0). Automated solid-phase extraction for the determination of polybrominated diphenyl ethers and polychlorinated biphenyls in serum—application on archived Norwegian samples from 1977 to 2003. Journal of Chromatography B: Analytical Technologies in the Biomedical and Life Sciences 846(1-2):252-263.		
HERO ID:		2158449		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods were reported
	Metric 2:	Analytical Methodology	High	Key analytical methods were reported
	Metric 3:	Biomarker Selection	High	Acceptable biomarker was reported
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was conducted in Norway
	Metric 5:	Currency	Low	Samples were collected between 1999 and 2003
	Metric 6:	Spatial and Temporal Variability	High	>10 samples were collected and replicates were collected.
	Metric 7:	Exposure Scenario	Medium	Exposure sources were not well characterized
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported
	Metric 9:	Quality Assurance	High	Limited QA were reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Few gaps and limitations were reported
Overall Quality Determination			High	

Study Citation:		Diaz-Torres, E., Gibson, R., Gonzalez-Farias, F., Zarco-Arista, A. E., Mazari-Hiriart, M. (2013.0). Endocrine Disruptors in the Xochimilco Wetland, Mexico City. Water, Air, and Soil Pollution 224(6):1-11.		
HERO ID:		2159828		
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	Mexico City
	Metric 5:	Currency	Medium	Samples collected in 2008 and 2009
	Metric 6:	Spatial and Temporal Variability	High	>10 samples; samples collected in triplicates
	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	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:		Labadie, P., Tlili, K., Alliot, F., Bourges, C., Desportes, A., Chevreuil, M. (2010.0). Development of analytical procedures for trace-level determination of polybrominated diphenyl ethers and tetrabromobisphenol A in river water and sediment. Analytical and Bioanalytical Chemistry 396(2):865-875.		
HERO ID:		2171725		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sample storage duration was not specified.
	Metric 2:	Analytical Methodology	High	Key analytical methods were reported.
	Metric 3:	Biomarker Selection	N/A	Study was tested for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in France.
	Metric 5:	Currency	Medium	Samples were collected in 2008.
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates were reported. Five river water samples and five river sediment samples were collected.
	Metric 7:	Exposure Scenario	Medium	Exposure source was not well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	High score selected for water because raw data is reported, however the score for sediment is medium because no raw data is reported.
	Metric 9:	Quality Assurance	High	Key QA/QC measures were reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations were reported.
Overall Quality Determination			High	

Study Citation:		Kim, U. J., Oh, J. E. (2014.0). Tetrabromobisphenol A and hexabromocyclododecane flame retardants in infant-mother paired serum samples, and their relationships with thyroid hormones and environmental factors. Environmental Pollution 184:193-200.		
HERO ID:		2324769		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology is missing information from data source and companion source such as sampling equipment and procedure and storage duration.
	Metric 2:	Analytical Methodology	High	Key analytical methods reported.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	South Korea
	Metric 5:	Currency	Medium	Date of sample collection not reported in data source but is reported in companion source (Kim et al., 2012) as 2009-2010.
	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/QC measures reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported.
Overall Quality Determination			Medium	

Study Citation:		Zeng, Y. H., Luo, X. J., Zheng, X. B., Tang, B., Wu, J. P., Mai, B. X. (2014.0). Species-specific bioaccumulation of halogenated organic pollutants and their metabolites in fish serum from an e-waste site, South China. Archives of Environmental Contamination and Toxicology 67(3):348-357.		
HERO ID:		2343681		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Two fish species were collected from a natural pond contaminated with e-waste. Whole blood were drawn from dorsal aorta using syringes into tube. Blood from four fish were pooled into one composite sample (6 for each fish species), centrifuged into 3 pooled serum samples for each species, and stored at -20C in Teflon tubes.
	Metric 2:	Analytical Methodology	Medium	Detailed sample preparation procedures are described in the SI, including LC-MS and recoveries. MDLs was only reported as a range from 4-11 pg/g ww for HBCDs and TBBPA.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in biota.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Qingyuan County, Guangdong province, South China
	Metric 5:	Currency	Medium	Sampling was performed in 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	48 fish samples (24 mud carp and 24 northern snakehead) were collected without replicates.
	Metric 7:	Exposure Scenario	High	Concentration in serum from fish were collected from a pond contaminated with e-waste.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1 provides the serum range. Pg 355 reports detection of TBBPA in all serum samples and provides mean concentration and std by species. No raw data were provided.
	Metric 9:	Quality Assurance	High	QA/QC techniques included method blanks and recoveries that ranged from 81-116%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variance was characterized with a range for serum samples and standard deviation by species. No limitations or gaps were provided.
Overall Quality Determination			Medium	

Study Citation:		Kowalski, B., Mazur, M. (2014.0). The simultaneous determination of six flame retardants in water samples using SPE pre-concentration and UHPLC-UV method. Water, Air, and Soil Pollution 225(3):1866.		
HERO ID:		2343691		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling Methodology	Critically Deficient	The authors did not discuss details of samples. They mentioned they collected surface water samples from various surface water bodies in Poland but no more details.
	Metric 2:	Analytical Methodology	High	This was a methods development paper so the authors provided a lot of detail on the analytical method, equipment, calibration, and recovery tests, and limits of detection.
	Metric 3:	Biomarker Selection	N/A	Water samples
Domain 2: Representativeness	Metric 4:	Geographic Area	High	The authors report where samples were collected from in Poland.
	Metric 5:	Currency	Medium	The authors did not report when samples were collected but the publication date is 2014.
	Metric 6:	Spatial and Temporal Variability	High	It seems the authors collected three samples from each of 9 locations in Poland. This would count as replicate samples.
	Metric 7:	Exposure Scenario	Medium	The exposure scenario is relative.
Domain 3: Accessibility/Clarity	Metric 8:	Reporting of Results	Medium	The authors report the mean concentration and standard deviation but not the range or the frequency of detection. They did not report individual sample concentrations.
	Metric 9:	Quality Assurance	Medium	The authors report recovery results but not controls.
Domain 4: Variability and Uncertainty	Metric 10:	Variability and Uncertainty	Low	The authors report a standard deviation. The authors did not discuss limitations of the sampling of surface water sources or gaps.

Overall Quality Determination

Uninformative

Study Citation:		Tang, J., Feng, J., Li, X., Li, G. (2014.0). Levels of flame retardants HBCD, TBBPA and TBC in surface soils from an industrialized region of East China. Environmental Science: Processes & Impacts 16(5):1015-1021.		
HERO ID:		2343699		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Most sampling methods were described, except for how soil samples were collected (e.g., equipment) before mixing with ones from similar sites.
	Metric 2:	Analytical Methodology	High	Key analytical methods were reported, including a citation to detailed analytical protocols.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in soil.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Ningbo, China.
	Metric 5:	Currency	Medium	Samples were collected in 2012.
	Metric 6:	Spatial and Temporal Variability	Medium	90 surface soil samples from the top 0-20cm were collected without replicates.
	Metric 7:	Exposure Scenario	High	Exposure to surface soils from nearby industrial activity is relevant. Authors described those industrial activities in Section 2.2.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	High	QA/QC was reported, including acceptable recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Gaps and limitations were not reported.
Overall Quality Determination			Medium	

Study Citation:		Suominen, K., Verta, M., Marttinen, S. (2014.0). Hazardous organic compounds in biogas plant end products-Soil burden and risk to food safety. Science of the Total Environment 491:192-199.		
HERO ID:		2343700		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	sampling context and methods described. Details of collection such as collection equipment and sample storage lacking
	Metric 2:	Analytical Methodology	High	LOQ in SI; modification of EPA 1614
	Metric 3:	Biomarker Selection	N/A	biogas end products
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Finland
	Metric 5:	Currency	Medium	2010-2012
	Metric 6:	Spatial and Temporal Variability	Medium	n = 7, no replicates
	Metric 7:	Exposure Scenario	High	discusses biogas products potential impact on food safety
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	min, max, mean, median 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:		Zhu, Z. C., Chen, S. J., Zheng, J., Tian, M., Feng, A. H., Luo, X. J., Mai, B. X. (2014.0). Occurrence of brominated flame retardants (BFRs), organochlorine pesticides (OCPs), and polychlorinated biphenyls (PCBs) in agricultural soils in a BFR-manufacturing region of North China. Science of the Total Environment 481:47-54.		
HERO ID:		2343705		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods were adequately reported, including site characteristics, equipment, and storage conditions. One sample was collected per site using a shovel, so sampler calibration is not applicable.
	Metric 2:	Analytical Methodology	High	Key analytical methods were reported.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in soil.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in China.
	Metric 5:	Currency	Medium	Samples were collected in 2008.
	Metric 6:	Spatial and Temporal Variability	Medium	38 samples were collected without replicates.
	Metric 7:	Exposure Scenario	High	Exposure to TBBPA in agricultural soil from China’s largest brominated FR manufacturing center is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Arithmetic mean, geometric mean, standard deviation, and raw data were reported in Table S1.
	Metric 9:	Quality Assurance	High	QA and QC techniques were reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Limitations and gaps were not reported.
Overall Quality Determination			High	

Study Citation:		Stapleton, H. M., Misenheimer, J., Hoffman, K., Webster, T. F. (2014.0). Flame retardant associations between children’s handwipes and house dust. Chemosphere 116(Special Issue):54-60.		
HERO ID:		2343712		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sample location, collection techniques and storage are reported in section 2.1.
	Metric 2:	Analytical Methodology	High	Sample extraction and analytical method are reported in section 2.2. LOD reported in table 1.
	Metric 3:	Biomarker Selection	N/A	Parent chemical measured in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected in USA, North Carolina
	Metric 5:	Currency	Medium	Samples collected during the spring of 2012
	Metric 6:	Spatial and Temporal Variability	High	The study analyses 30 handwipes and 30 samples of house dust.
	Metric 7:	Exposure Scenario	High	The study analyzes the association between dust and handwipes.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data is not reported. Table 1 reports GM and range.
	Metric 9:	Quality Assurance	High	The study reports, recoveries, the use of laboratory and field blanks, and standard reference materials.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability reported in terms of range, limitations are not reported.
Overall Quality Determination			High	

Study Citation:		Fromme, H., Hilger, B., Kopp, E., Miserok, M., Völkel, W. (2014.0). Polybrominated diphenyl ethers (PBDEs), hexabromocyclododecane (HBCD) and "novel" brominated flame retardants in house dust in Germany. Environment International 64:61-68.		
HERO ID:		2343719		
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 (German guideline VDI 4300-8, 2001).
	Metric 2:	Analytical Methodology	Medium	Analytical methodology is discussed in detail and is clear and appropriate (i.e., scientifically sound) for the chemical and media of interest; however, recovery samples are not discussed.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Germany
	Metric 5:	Currency	Low	Sample collection date is not reported. Study was published in 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	>10 samples were collected but there were no replicates.
	Metric 7:	Exposure Scenario	Medium	The data closely represent relevant/realistic exposure scenario but is not well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data reported. Summary statistics reported in Table 2.
	Metric 9:	Quality Assurance	Medium	QA/QC techniques and results were not thoroughly discussed, but can be implied through the study's use of standard field and laboratory protocols. The study compared measured concentrations to reported concentrations in standard reference material NIST SRM 2585.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study has limited discussion of key uncertainties, limitations, and data gaps.
Overall Quality Determination			Medium	

Study Citation:		Eulaers, I., Jaspers, V. L., Pinxten, R., Covaci, A., Eens, M. (2014.0). Legacy and current-use brominated flame retardants in the Barn Owl. Science of the Total Environment 472:454-462.		
HERO ID:		2343720		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sample methods were reported in detail. Note that methods focused more heavily on how researchers dissected, preserved, and stored tissue samples.
	Metric 2:	Analytical Methodology	High	Extraction, analytical, and instrumentation methods were described in text with additional references for further details. LOQs are available in Table SI-2.
	Metric 3:	Biomarker Selection	N/A	Study tested for parent chemical in biota.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Barn owls were collected from Flanders, Belgium and Normandy, France.
	Metric 5:	Currency	Medium	Samples collected in 2008 and 2009
	Metric 6:	Spatial and Temporal Variability	Medium	Depending on tissue and feather types, 3-15 and 11-14, respectively, samples were collected between France and Belgium.
	Metric 7:	Exposure Scenario	Medium	Bird samples collected from France were closer to Europe’s sole HBCD production plant, which could be an exposure source. However, there was no discussion possible sources for TBBPA.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics include median, min, and max. Raw data were not reported. DFs were reported for TBBPA, which was detected below LOQ for all samples.
	Metric 9:	Quality Assurance	Medium	Some QA/QC was reported in the last paragraph of Methods (e.g., blanks, blank correction).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Gaps and limitations only pertained to using feathers as a non-destructive sampling strategy and not the monitoring data itself.
Overall Quality Determination			Medium	

Study Citation:		Lankova, D., Lacina, O., Pulkrabova, J., Hajslova, J. (2013.0). The determination of perfluoroalkyl substances, brominated flame retardants and their metabolites in human breast milk and infant formula. Talanta 117:318-325.		
HERO ID:		2343724		
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 reported
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Czech Republic
	Metric 5:	Currency	Medium	Samples collected in 2010
	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			High	

Study Citation:		Hloušková, V., Lanková, D., Kalachová, K., Hrádková, P., Poustka, J., Hajšlová, J., Pulkrabová, J. (2014.0). Brominated flame retardants and perfluoroalkyl substances in sediments from the Czech aquatic ecosystem. Science of the Total Environment 470-471:407-416.		
HERO ID:		2343734		
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	Czech Republic
	Metric 5:	Currency	Medium	Samples collected in 2010
	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			High	

Study Citation:		Takeuchi, S., Kojima, H., Saito, I., Jin, K., Kobayashi, S., Tanaka-Kagawa, T., Jinno, H. (2014.0). 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:		Schreder, E. D., La Guardia, M. J. (2014.0). Flame retardant transfers from U.S. households (dust and laundry wastewater) to the aquatic environment. Environmental Science & Technology 48(19):11575-11583.		
HERO ID:		2528320		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The dust and wastewater sampling methods were described in detail.
	Metric 2:	Analytical Methodology	High	The analytical methods were described and included recoveries and LOD.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed dust and wastewater samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Vancouver and Longview, WA.
	Metric 5:	Currency	Medium	Researchers visited homes to collect dust and laundry wastewater in 2011 and 2012.
	Metric 6:	Spatial and Temporal Variability	Medium	A total of 20 household’s samples were collected, no replicates were reported.
	Metric 7:	Exposure Scenario	High	Data closely represent relevant exposure scenarios related to household indoor dust and wastewater from
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Individual FR results are in the SI file. Summary statistics is presented in figures.
	Metric 9:	Quality Assurance	High	QA/QC details are in the SI file.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variability was characterized (range). Uncertainties and study limitations were briefly discussed.
Overall Quality Determination			High	

Study Citation:		Reindl, A. R., Falkowska, L. (2014.0). Flame retardants at the top of a simulated baltic marine food web- A case study concerning african penguins from the Gdansk zoo. Archives of Environmental Contamination and Toxicology 68(2):259-264.		
HERO ID:		2528326		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Fish samples were collected once a month from Dec to February. Guano was collected from mat covering enclosure. Unhatched penguin eggs obtained during breeding season (autumn and spring). Several tissue types were collected from dead birds. Samples were homogenized and placed in jars without any further description of sampling methods.
	Metric 2:	Analytical Methodology	High	All pertinent information was included (e.g., Soxhlet method, HPLC, recoveries, and an LOQ of 0.9ug/kg^3).
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in animals.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Studies was performed at the Gdansk Zoo, Poland.
	Metric 5:	Currency	Medium	Samples were collected during 2009-2010.
	Metric 6:	Spatial and Temporal Variability	Medium	9 fish; 6 muscle tissue; 6 livers; 3 whole eggs; 3 yolk; 3 albumen; 3 dead birds. Replicates were not reported.
	Metric 7:	Exposure Scenario	Medium	Study measured concentration in penguins from a zoo and their food (fish) to determine accumulation in different tissue and organs. Since these penguins are from the zoo, it is unclear how their exposure scenario will be different from non-captive animals.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Some raw data and summary statistics were provided tissues and organs of penguins and in eggs. Data for fish are graphical.
	Metric 9:	Quality Assurance	High	QA/QC techniques were described, including blank samples and recovery that was acceptable.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Limited characterization of variance; standard deviation only available for TBBPA in eggs. There was no discussion of uncertainties and limitations.
Overall Quality Determination			Medium	

Study Citation:		Zhou, X., Guo, J.,ie, Zhang, W.,ei, Zhou, P., Deng, J., Lin, K. (2014.0). Tetrabromobisphenol A contamination and emission in printed circuit board production and implications for human exposure. Journal of Hazardous Materials 273:27-35.		
HERO ID:		2529846		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Figure 1 depicts where in the production flow samples were collected, while Table 1 provides sample information. Three sets of samples were taken in three separated days with one-month intervals. Collection procedure and storage conditions were sufficiently discussed in Section 2.2.
	Metric 2:	Analytical Methodology	High	The extraction method (GC-NCI-MS) was discussed Section 2.3. Recoveries and LODs were reported. For LODs, they were 1.20 ng/g and 0.23 ng/L in solid and aqueous samples.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in the environment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in eastern China.
	Metric 5:	Currency	Medium	Samples were collected during 2011-2012.
	Metric 6:	Spatial and Temporal Variability	Medium	3-6 samples were taken from each media type without replicates.
	Metric 7:	Exposure Scenario	High	TBBPA concentrations in production waste (fine solid waste, rinsing water, effluent, and sludge) from a typical PCB plant is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 2 provides the mean, min, and max concentrations in each sampling point. No raw data are available.
	Metric 9:	Quality Assurance	High	Authors adequately described QA/QC procedures, including recoveries that are acceptable.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	There was no discussion of uncertainties and limitations.
Overall Quality Determination			High	

Study Citation:		Zhou, X., Guo, J., Zhang, W., Zhou, P., Deng, J., Lin, K. (2014.0). Occurrences and inventories of heavy metals and brominated flame retardants in wastes from printed circuit board production. Environmental Science and Pollution Research 21(17):10294-10306.		
HERO ID:		2539681		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	effluent collected from pipelines in different location in the industrial WTF using peristaltic pumps, stored in glass jar at 4C, filtered; dewatered sludge collected, wrapped in pre-baked aluminum foil, stored at -20C soxhlet extracted and solid-phase extraction; GC-NCI-MS; recoveries; LOD was 1.20 ng/g and 0.23 ng/L in solid and aqueous samples, respectively
	Metric 2:	Analytical Methodology	High	
	Metric 3:	Biomarker Selection	N/A	NA - solid and liquid waste no biomarker needed.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Shanghai, China
	Metric 5:	Currency	Medium	December 2011 and February 2012
	Metric 6:	Spatial and Temporal Variability	Low	3 samples each of effluent and dewatered sludge; collected on separate days, spaced over 1-month period between December and February
	Metric 7:	Exposure Scenario	Medium	concentration in effluent and dewatered sludge that were discharged from an industrial wastewater treatment facility from a PCB manufacturing plant
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 3 provides mean and std deviation in dewatered sludge and effluent from the industrial WTF
	Metric 9:	Quality Assurance	High	Field, laboratory, and procedure blanks; recoveries ranged from 83.1 to 107.32%
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	no discussion of variability or uncertainty
Overall Quality Determination			Medium	

Study Citation:		Di Napoli-Davis, G., Owens, J. E. (2013.0). Quantitation of tetrabromobisphenol-A from dust sampled on consumer electronics by dispersed liquid-liquid microextraction. Environmental Pollution 180:274-280.		
HERO ID:		2550601		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods were well-described. Different swabbing materials were even evaluated to identify the best option.
	Metric 2:	Analytical Methodology	High	Analytical methods were well-described. In some cases, multiple techniques were compared.
	Metric 3:	Biomarker Selection	N/A	They tested for the parent chemical on consumer products.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in USA.
	Metric 5:	Currency	Low	The sampling date was not identified, but the study was published in 2013.
	Metric 6:	Spatial and Temporal Variability	Low	There were 29 samples and 5 replicates per consumer product.
	Metric 7:	Exposure Scenario	Medium	Data likely represents relevant exposure scenarios, but the study is missing details about the setting in which some of the consumer products were located and the population of interest. There were no exposure controls.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Limited summary statistics were included (mean and relative SD), per type of consumer product, but no raw data.
	Metric 9:	Quality Assurance	High	QA/QC techniques were well-described, including calibration, use of blanks, determination of recoveries, and discussion of precision.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The authors characterized variability, but did not discuss uncertainties and limitations.
Overall Quality Determination			Medium	

Study Citation:		Dodson, R. E., Perovich, L. J., Covaci, A., Van den Eede, N., Ionas, A. C., Dirtu, A. C., Brody, J. G., Rudel, R. A. (2012.0). After the PBDE phase-out: A broad suite of flame retardants in repeat house dust samples from California. Environmental Science & Technology 46(24):13056-13066.		
HERO ID:		2557649		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sample collection is well described in the materials and methods sections. Samples were collected by trained personnel using a Eureka Mighty-Mite vacuum cleaner over surfaces in living areas of the home. After sieving, samples were stored at $-16^{\circ}\text{C} \pm 10^{\circ}\text{C}$.
	Metric 2:	Analytical Methodology	High	Analytical methodology including extraction methods and analytical equipment is described in the supporting information section. LC-MS/MS was used with 13C-TBBPA as the internal standard. The LOD and LOQ are reported in Table 1 per each chemical.
	Metric 3:	Biomarker Selection	N/A	The study measures the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in California, specifically in two San Francisco Bay Area communities.
	Metric 5:	Currency	Medium	Samples were collected in 2006 and 2011.
	Metric 6:	Spatial and Temporal Variability	Medium	Dust samples were collected in 16 northern California homes in 2006 and again in the same homes with the same participants in 2011. The season of sampling was not provided. No replicates samples per house were collected.
	Metric 7:	Exposure Scenario	High	This study evaluates the concentrations of flame retardants in house dust during two sampling years. Residents were surveyed about the presence of furniture, carpets, and electronics, particularly if any items were introduced to the home since the 2006 sample collection.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual data points are not reported, only the summary of statistics in table 1.
	Metric 9:	Quality Assurance	High	This study reports a range of QA/QC methods in the supporting information, including six procedural blanks, recovery calculations using matrix spikes, and inter laboratory calibrations.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variability is reported as range (min - max) and temporally variability (2006-2011). The study also has a section to report the limitations of the research.
Overall Quality Determination			High	

Study Citation:		Mäkinen, M. S. E., Mäkinen, M. R. A., Koistinen, J. T. B., Pasanen, A. L., Pasanen, P. O., Kalliokoski, P. J., Korpi, A. M. (2009.0). Respiratory and dermal exposure to organophosphorus flame retardants and tetrabromobisphenol A at five work environments. Environmental Science & Technology 43(3):941-947.		
HERO ID:		2560628		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	For personal and area pump air sampling, sampling equipment, procedures, storage conditions and duration, calibration of sampler and study site characteristics depicted. For personal patch and handwash sampling, insufficient information provided on calibration, storage duration.
	Metric 2:	Analytical Methodology	Medium	Analytical methodology was described, though there was insufficient information on chemical-specific recoveries and LODs (indicated to be within further information in SI).
	Metric 3:	Biomarker Selection	N/A	Sampling for parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The location is assumed to be Finland based on site descriptions within SI Table S1.
	Metric 5:	Currency	Low	Sampling dates assumed to be within SI Tables S1-S7. The publication date is 2009.
	Metric 6:	Spatial and Temporal Variability	Medium	Sample sizes are reported in SI Table S1.
	Metric 7:	Exposure Scenario	Medium	Sampling for non-occupational and occupationally relevant locations, including computer classrooms, noted in Table 2.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary stats are reported within Table 2, and additional data are reported within SI.
	Metric 9:	Quality Assurance	Medium	Recoveries, field and laboratory blanks are reported, but there was no pre-exposure sampling.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Authors note limitations of high detection limits, however do not discuss use of high detection limit for concentration in samples with > 50% of samples <LOD and variability in area air sampling time between locations.
Overall Quality Determination			Medium	

Study Citation:		Alliot, F., Moreau-Guigon, E., Bourges, C., Desportes, A., Teil, M. J., Blanchard, M., Chevreuil, M. (2014.0). A multi-residue method for characterization of endocrine disruptors in gaseous and particulate phases of ambient air. Atmospheric Environment 92:1-8.		
HERO ID:		2658345		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology reported all pertinent aspects, such as equipment/devices, location, timing, and storage conditions. Extraction, equipment, and LOQ were reported. Study tested parent chemicals in ambient air.
	Metric 2:	Analytical Methodology	High	
	Metric 3:	Biomarker Selection	N/A	
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was conducted in France.
	Metric 5:	Currency	Medium	Samples collected in fall 2011 according to Section 3.3.
	Metric 6:	Spatial and Temporal Variability	Low	Three samples were collected successively per site (3 total), which is not adequate to characterize temporal trends. Replicate samples were not reported.
	Metric 7:	Exposure Scenario	High	Exposure scenario - ambient air in an apartment, office, and day nursery - is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only the mean of 3 samples is reported - missing most summary statistics. Raw data are not available.
	Metric 9:	Quality Assurance	Low	QA/QC well described in appendices including instrument detection limit, recoveries, and blanks. However, recoveries are low especially for TBBPA and gaseous phase of DEHP (63%). Low recoveries for TBBPA was not detected because of the use of an internal standard method, which was not described. Authors considered the recovery for gaseous phase of DEHP as acceptable, but not according to the monitoring guide.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variance, uncertainties, gaps, and limitations were not discussed.
Overall Quality Determination			Medium	

Study Citation:		Fujii, Y., Nishimura, E., Kato, Y., Harada, K. H., Koizumi, A., Haraguchi, K. (2014.0). Dietary exposure to phenolic and methoxylated organohalogen contaminants in relation to their concentrations in breast milk and serum in Japan. Environment International 63:19-25.		
HERO ID:		2818993		
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	Japan
	Metric 5:	Currency	Medium	Samples collected in 2004 and 2009
	Metric 6:	Spatial and Temporal Variability	High	>10 samples; 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			High	

Study Citation:		Huber, S., Warner, N. A., Nygård, T., Remberger, M., Harju, M., Uggerud, H. T., Kaj, L., Hanssen, L. (2015.0). A broad cocktail of environmental pollutants found in eggs of three seabird species from remote colonies in Norway. Environmental Toxicology and Chemistry 34(6):1296-1308.		
HERO ID:		2823276		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology was described, such as sampling procedures, storage conditions, and matrix characteristics.
	Metric 2:	Analytical Methodology	High	LOD reported in tables in supplement. The analytical method sufficiently described.
	Metric 3:	Biomarker Selection	N/A	Analyte is the parent chemical in eggs.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected in 2 remote islands, Sklinna and Rost, on the Norwegian coast.
	Metric 5:	Currency	Medium	Eggs collected during breeding season between May and June 2012.
	Metric 6:	Spatial and Temporal Variability	Medium	Eggs collected from three seabird species: 6 eggs from one island and 12 eggs from a second island per species. 3 eggs pooled per location/species (homogenized together) before analysis.
	Metric 7:	Exposure Scenario	High	This is a biomonitoring study where seabird transfer of ingested chemicals to their eggs is analyzed.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data for individual pooled samples (3 eggs per) presented in Supplement. All 18 measurements below LOD.
	Metric 9:	Quality Assurance	Medium	QA/QC described briefly in Supplement Section 1.13, including 3 types of blanks. No recoveries discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty not reported.
Overall Quality Determination			High	

Study Citation:		Svihlikova, V., Lankova, D., Poustka, J., Tomaniova, M., Hajslova, J., Pulkrabova, J. (2015.0). Perfluoroalkyl substances (PFASs) and other halogenated compounds in fish from the upper Labe River basin. Chemosphere 129:170-178.		
HERO ID:		2851070		
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	Czech Republic
	Metric 5:	Currency	Medium	Samples collected in 2010
	Metric 6:	Spatial and Temporal Variability	High	>10 samples; 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:		Luigi, V., Giuseppe, M., Claudio, R. (2015.0). Emerging and priority contaminants with endocrine active potentials in sediments and fish from the River Po (Italy). Environmental Science and Pollution Research 22(18):14050-14066.		
HERO ID:		2919854		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sediment and fish sampling equipment and procedures were reported, including storage conditions.
	Metric 2:	Analytical Methodology	Medium	Methods described elsewhere; LOD in text.
	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	Study was conducted in Po River Italy.
	Metric 5:	Currency	Medium	Samples were collected in 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	river n=5; fish n=12; no replicates.
	Metric 7:	Exposure Scenario	Medium	The samples represent chemical concentration in sediment and fish, although the source of contamination cannot be attributed.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	all data reported in tables 1 and 2
	Metric 9:	Quality Assurance	High	Recoveries included. QA discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability is captured in the different sites sampled. Uncertainties are not discussed.
Overall Quality Determination			High	

Study Citation:		Matsukami, H., Nguyen Minh Tue, Suzuki, G.,o, Someya, M., Le Huu Tuyen, Pham Hung Viet, Takahashi, S., Tanabe, S., Takigami, H. (2015.0). Flame retardant emission from e-waste recycling operation in northern Vietnam: Environmental occurrence of emerging organophosphorus esters used as alternatives for PBDEs. Science of the Total Environment 514:492-499.		
HERO ID:		2942545		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling methodology was described but the storage duration of samples was not reported.
	Metric 2:	Analytical Methodology	High	The analytical methods were described, including LOQ and recoveries.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed soil samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Bui Dau, Vietnam.
	Metric 5:	Currency	Medium	The samples were collected in 2012.
	Metric 6:	Spatial and Temporal Variability	Low	n=32 samples in total, without replicates.
	Metric 7:	Exposure Scenario	High	The data likely represent relevant exposure scenarios related to flame retardants in soils from Bui Dau, Vietnam but the sample size limits the results’ generalizability.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The study did not report individual sample data for soil measurements, but they did report them for sediment samples. Limited summary statistics were reported.
	Metric 9:	Quality Assurance	Medium	The study did not report if they collected field blanks but they did use procedural blanks.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The authors reported a limited characterization of variability (range). Uncertainties and limitations were not discussed.
Overall Quality Determination			Medium	

Study Citation:		Huang, D., Zhao, H., Liu, C. P., Sun, C. (2014.0). Characteristics, sources, and transport of tetrabromobisphenol A and bisphenol A in soils from a typical e-waste recycling area in South China. Environmental Science and Pollution Research 21(9):5818-5826.		
HERO ID:		2948383		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Surface soil samples were collected from different villages (Fig 1 and Table 1). Topsoil (0-20cm) was collected using stainless steel scoop. Soil profile samples taken from top layer to bottom layer (0–20, 20–40, 40–60, and 60–80 cm). Samples were freeze-dried, ground, sieved, and stored at -18C.
	Metric 2:	Analytical Methodology	High	Analytical methods (e.g., Soxhlet and GC-MS) and recoveries were reported. LOQ was 0.30ng/g.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in soil.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Sampling was conducted in the Longtang area, northern Guangdong Province, southern China.
	Metric 5:	Currency	Medium	Samples were collected in 2011.
	Metric 6:	Spatial and Temporal Variability	Medium	Samples were collected from nine villages. Six surface soil types and three soil profiles were collected, with 1-5 samples per type (Table 1). All samples were collected during the dry season in January. No replicates were reported.
	Metric 7:	Exposure Scenario	High	Contamination in different land-use soils (former open burning sites, dismantling sites (including open air sites and workshops), paddy fields, vegetable fields, wasteland, and pond sediments.) from a e-waste recycling area is relevant to the local population and crops that are grown in the soil.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 3 provides the mean and std deviation by village and soil type. No raw data were available.
	Metric 9:	Quality Assurance	High	There is a robust discussion of QA/QC techniques, including blanks and recoveries that ranged from 92.8 to 108.5%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	There is no discussion of limitations and uncertainties.
Overall Quality Determination			High	

Study Citation:		Wu, Y., Li, Y., Kang, D., Wang, J., Zhang, Y., Du, D., Pan, B., Lin, Z., Huang, C., Dong, Q. (2016.0). Tetrabromobisphenol A and heavy metal exposure via dust ingestion in an e-waste recycling region in Southeast China. Science of the Total Environment 541:356-364.		
HERO ID:		3007772		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods (e.g., site matrix, collection regimen, equipment) were reported.
	Metric 2:	Analytical Methodology	High	Key analytical methods (e.g., sample preparation, GC-EI-MS, LOD) were reported.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in dust.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in southeast China.
	Metric 5:	Currency	Medium	Samples collected in 2012
	Metric 6:	Spatial and Temporal Variability	Medium	Indoor and outdoor dust was collected from five sampling areas with 7-16 samples at each site and without replicates.
	Metric 7:	Exposure Scenario	High	Exposure source characterized as proximity to a e-waste recycling facility, and ingestion of dust is a relevant pathway.
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.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	There was no discussion of limitations or uncertainties.
Overall Quality Determination			High	

Study Citation:		La Guardia, M. J., Hale, R. C. (2015.0). Halogenated flame-retardant concentrations in settled dust, respirable and inhalable particulates and polyurethane foam at gymnastic training facilities and residences. Environment International 79:106-114.		
HERO ID:		3012534		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Air, dust, and foam sampling methods were all well described and included details on sampling equipment preparation and sample storage.
	Metric 2:	Analytical Methodology	Medium	Extraction protocol was adequately described. Mass spectrometry method was only briefly described, and authors point to other publications for method details.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected from gyms in Seattle, WA.
	Metric 5:	Currency	Low	Sampling date was not reported; the publication date is 2015.
	Metric 6:	Spatial and Temporal Variability	Medium	Foam samples were collected in replicates of 4 samples. Air sampling was not replicated beyond 24 hours. Dust sampling replicates are not described.
	Metric 7:	Exposure Scenario	High	Potential exposure to gymnasts and coaches were characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data was not presented in the paper but thorough summary data was provided.
	Metric 9:	Quality Assurance	High	QA/QC included calculation of recovery, analyzing blanks, and some replicate analysis.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Deviation was calculated but error or uncertainty were not calculated or discussed.
Overall Quality Determination			Medium	

Study Citation:		Wang, W., Abualnaja, K. O., Asimakopoulos, A. G., Covaci, A., Gevao, B., Johnson-Restrepo, B., Kumosani, T. A., Malarvannan, G., Minh, T. B., Moon, H. B., Nakata, H., Sinha, R. K., Kannan, K. (2015.0). A comparative assessment of human exposure to tetrabromobisphenol A and eight bisphenols including bisphenol A via indoor dust ingestion in twelve countries. Environment International 83:183-191.		
HERO ID:		3021171		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology is missing detailed information such as sampling equipment and procedure and storage duration.
	Metric 2:	Analytical Methodology	High	Key analytical methods reported.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	12 countries
	Metric 5:	Currency	Medium	Sampling campaign occurred from 2010 to 2014. SI details sampling period by country.
	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/QC measures reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported.
Overall Quality Determination			Medium	

Study Citation:		Keller, A. S., Raju, N. P., Webster, T. F., Stapleton, H. M. (2014.0). Flame Retardant Applications in Camping Tents and Potential Exposure. Environ-mental Science & Technology Letters 1(2):152-155.		
HERO ID:		3023922		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The authors used convenience sampling, they reported the sampling procedures and equipment used to collect the samples. The storage conditions were reported but not the storage duration.
	Metric 2:	Analytical Methodology	Low	The authors did not report the limit of detection in the main article. They also only referenced another paper for the analytical methods used in this study. These were reported in the 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	The authors report a geographic area.
	Metric 5:	Currency	Medium	The authors did not report a sampling year but the publication year is 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	The authors collected 11 different tent samples, and then they collected 20 wipe samples and 11 hand wipe samples. Given they sampled multiple people this could count as replicate samples, however they used conve-nient sampling based on what campers they encountered at a certain timepoint.
	Metric 7:	Exposure Scenario	High	This is a plausible exposure scenario.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The authors reported the frequency of detection, median and range of concentrations, and number of samples. They did not report a standard deviation or individual sample concentrations.
	Metric 9:	Quality Assurance	Medium	The details about the QA/QC procedures were in the supplemental information. The authors used lab blanks and reported recovery results, one of which was below 70%. They did not collect field controls/blanks.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The authors did not report a measure of variance. They discussed limitations and variations in comparing their data to other studies.
Overall Quality Determination			Medium	

Study Citation:		Sühring, R., Barber, J. L., Wolschke, H., Kötke, D., Ebinghaus, R. (2015.0). Fingerprint analysis of brominated flame retardants and Dechloranes in North Sea sediments. Environmental Research 140:569-578.		
HERO ID:		3034798		
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	Several European countries
	Metric 5:	Currency	Medium	Samples collected in 2012 and 2013
	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			High	

Study Citation:		Buckley, J. P., Herring, A., Wolff, M. S., Calafat, A. M., Engel, S. M. (2016.0). Prenatal exposure to environmental phenols and childhood fat mass in the Mount Sinai Children’s Environmental Health Study. Environment International 91:350-356.		
HERO ID:		3230500		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	There was very little description of sampling methodology because the methodology was reported in earlier papers. Since samples were analyzed at CDC, it is likely that collection methods and storage conditions and duration were suitable.
	Metric 2:	Analytical Methodology	Medium	There was very little description of analytical methods because methodology was reported in earlier papers. Since analysis of urine samples was done at CDC, it is likely that analytical methodology was scientifically sound and according to publicly available SOPs. LODs were specified in Table 2.
	Metric 3:	Biomarker Selection	Low	While they did analyze for BPA in urine in this study, and BPA is a possible metabolite of TBBPA, other sources of BPA could have contributed to the measured concentrations.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	USA
	Metric 5:	Currency	Low	Sampling began in 1998
	Metric 6:	Spatial and Temporal Variability	Low	N=173. They collected a single spot sample from each mother. Since it was an un-pooled spot sample, rated this as low. There were not replicates mentioned in this paper.
	Metric 7:	Exposure Scenario	Medium	Data closely represents relevant exposure scenarios. However, exposure sources were not well-characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	They only reported summary statistics, such as mean, min, 25th percentile, 75th percentile, max, and detection frequency. No raw data were included.
	Metric 9:	Quality Assurance	Low	There is no discussion of QA/QC except to cite previously published work that describes QA/QC methods. However, analysis at CDC suggests that there were standard QA/QC practices incorporated.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	The paper characterized variability and discussed uncertainties and limitations, mainly related to how well a single spot sample could represent exposures over an extended period and related to the endpoints observed in the children later born to the mothers whose urine was sampled.
Overall Quality Determination			Medium	

Study Citation:		Laborie, S., Moreau-Guigon, E., Alliot, F., Desportes, A., Oziol, L., Chevreuil, M. (2016.0). 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:		Liu, H. H., Hu, Y. J., Luo, P., Bao, L. J., Qiu, J. W., Leung, K. M. Y., Zeng, E. Y. (2014.0). Occurrence of halogenated flame retardants in sediment off an urbanized coastal zone: Association with urbanization and industrialization. Environmental Science & Technology 48(15):8465-8473.		
HERO ID:		3345121		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Key sampling methods (e.g., site characteristics, grab sampler, equipment, storage conditions) were reported.
	Metric 2:	Analytical Methodology	Low	Analytical methods were very detailed, but LOD/LOQs were missing.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in sediment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected form Daya Bay in China (Other Foreign) and Hong Kong (High Income Foreign)
	Metric 5:	Currency	Medium	Samples collected in 2012
	Metric 6:	Spatial and Temporal Variability	Medium	18 and 35 surface sediment samples were collected in Daya Bay and Hong Kong waters, respectively.
	Metric 7:	Exposure Scenario	High	Potential industrial sources of TBBPA and other flame retardants were discussed and visualized in Figure 1.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data were not reported. Summary statistics were mostly missing except for a range in Table S4.
	Metric 9:	Quality Assurance	Medium	QA/QC methods, including procedural blank, solvent spiking blank, matrix spiking blank, duplicate analysis, and recoveries were reported. However, recoveries are low matrix spiking blank.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Characterization of variance and discussion of uncertainties or limitations were missing.
Overall Quality Determination			Medium	

Study Citation:		Gong, Y., Tian, H.,ua, Dong, Y., Zhang, X., Wang, J.,un, Wang, W.,ei, Ru, S. (2016.0). Thyroid disruption in male goldfish (Carassius auratus) exposed to leachate from a municipal waste treatment plant: Assessment combining chemical analysis and in vivo bioassay. Science of the Total Environment 554:64-72.		
HERO ID:		3350229		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling methodology was only briefly discussed. Details about volume of samples taken from storage tanks, locations, and storage conditions were provided. Samples of leachate and treated effluent were collected.
	Metric 2:	Analytical Methodology	Medium	The analytical methodology was described in detail. The authors reported LODs but did not report recoveries.
	Metric 3:	Biomarker Selection	N/A	The authors did not test for biomarkers. They tested for the parent chemicals of interest in aqueous samples and analyzed the samples within a week of collection.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The authors took samples from a municipal solid waste treatment plant in Qingdao, China.
	Metric 5:	Currency	Medium	The samples were collected in September, 2014.
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	The study did not report the sample size and cannot be inferred.
	Metric 7:	Exposure Scenario	High	The data closely represent relevant exposure scenario to phthalates in treated effluents and leachate. The authors also conducted an in vivo bioassay to characterize this exposure in goldfish.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The authors only provided summary statistics (range and means) in Table 4. The values were provided for leachate and 3 sampling points in the treatment process. They also provided estimates concentrations in exposure media on Table 5. That said, TBBPA was below limit of detection in this study (reported in text on page 67).
	Metric 9:	Quality Assurance	Low	Details about QA/QC techniques were only briefly described. Supplementary data may include more details but the file was inaccessible during evaluation.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The authors characterized variability by reporting range of values detected. The uncertainties and limitations were only briefly discussed at the end of the manuscript.
Overall Quality Determination			Uninformative	

Study Citation:		Zeng, Y. H., Luo, X. J., Tang, B., Mai, B. X. (2016.0). Habitat- and species-dependent accumulation of organohalogen pollutants in home-produced eggs from an electronic waste recycling site in South China: Levels, profiles, and human dietary exposure. Environmental Pollution 216:64-70.		
HERO ID:		3350467		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Most sampling methods are reported, but this section could benefit from more details on how the eggs were collected (e.g., by trained researchers with certain criteria or completely random), how egg contents were transferred, or the types of glass jars.
	Metric 2:	Analytical Methodology	Medium	Key analytical methods were reported. However, MDLs for HBCD and TBBA was reported as 0.7-1.7 ng/g lw (lipid weight).
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in chicken and goose eggs.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Guiyu, China.
	Metric 5:	Currency	Medium	Samples were collected in 2013.
	Metric 6:	Spatial and Temporal Variability	Medium	17 chicken eggs and 23 goose eggs were collected from two different sites without replicates.
	Metric 7:	Exposure Scenario	High	Consumption of the eggs produced in areas with a large e-waste recycling industry is relevant to human exposure.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	Medium	QA/QC methods were described, but the average recovery for TBBPA was 50-108%. There was no discussion of correcting for the lower end.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Some limitations were reported only for the dose estimate, not the monitoring data.
Overall Quality Determination			Medium	

Study Citation:		Zhang, H., Bayen, S., Kelly, B. C. (2015.0). Co-extraction and simultaneous determination of multi-class hydrophobic organic contaminants in marine sediments and biota using GC-EI-MS/MS and LC-ESI-MS/MS. Talanta 143:7-18.		
HERO ID:		3350497		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods and equipment reported. Sites and storage reported also.
	Metric 2:	Analytical Methodology	High	GC-EI-MS/MS and LC-ESI-MS/MS; MDLs provided (Table 1); additional information in SI
	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	two separate coastal location around Singapore - off-shore site (east coast) and near-shore mangrove site (Mandai mangrove)
	Metric 5:	Currency	Low	no sampling date; published 2015;
	Metric 6:	Spatial and Temporal Variability	Medium	sediments (6); worms (3); clams (8); sediments (6), catfish (11), grunter (5); Section 3.4 and SI
	Metric 7:	Exposure Scenario	Medium	Measured concentrations in sediment and fish, although the source of exposure is not discussed.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Section 3.4 and SI; TBBPA only detected in sediments (0.05-0.059 ng/g dw)
	Metric 9:	Quality Assurance	High	Section 2.5
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	levels generally comparable to previous studies
Overall Quality Determination			High	

Study Citation:		Fernandes, A. R., Mortimer, D., Rose, M., Smith, F., Panton, S., Garcia-Lopez, M. (2016.0). Bromine content and brominated flame retardants in food and animal feed from the UK. Chemosphere 150:472-478.		
HERO ID:		3350498		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sample collection for commonly consumed foods available from retail outlets is straightforward. However, collecting fish samples from marine waters or animal feeds from commercial sources require more detail than was provided. Storage conditions were not detailed either.
	Metric 2:	Analytical Methodology	Medium	Key analytical methods were reported, including references to previously validated protocols. However, LOD was only provided as "0.01ng/g for most analytes and typically 0.01-0.1 ng/g for deca-BDE depending on the matrix."
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in food and animal feed.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in the UK.
	Metric 5:	Currency	Medium	Samples were collected in 2013.
	Metric 6:	Spatial and Temporal Variability	Medium	About 400 samples were collected without replicates.
	Metric 7:	Exposure Scenario	High	Exposure to food via either direct consumption or indirectly from the animal feed is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	Medium	Some QA was reported, such as blanks and duplicate analysis. Recoveries reported as a range for all chemicals combined as 50-110%. Additional QA/QC protocols can be inferred through its use of an accredited analytical process.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some discussion of limitations was provided.
Overall Quality Determination			Medium	

Study Citation:		Wang, J., Jia, X., Gao, S., Zeng, X., Li, H., Zhou, Z., Sheng, G., Yu, Z. (2016.0). Levels and distributions of polybrominated diphenyl ethers, hexabromocyclododecane, and tetrabromobisphenol A in sediments from Taihu Lake, China. Environmental Science and Pollution Research 23(11):10361-10370.		
HERO ID:		3350514		
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	China
	Metric 5:	Currency	Medium	Samples collected in 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	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			High	

Study Citation:		Harrad, S., Abdallah, M. A. (2015.0). Concentrations of polybrominated diphenyl ethers, hexabromocyclododecanes and tetrabromobisphenol-A in breast milk from United Kingdom women do not decrease over twelve months of lactation. Environmental Science & Technology 49(23):13899-13903.		
HERO ID:		3350532		
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	NA - measured parent chemical in breastmilk
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	UK
	Metric 5:	Currency	Medium	Samples collected in 2010 and 2011
	Metric 6:	Spatial and Temporal Variability	High	>10 samples; 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 SI
	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:		Tang, B., Zeng, Y. H., Luo, X. J., Zheng, X. B., Mai, B. X. (2015.0). Bioaccumulative characteristics of tetrabromobisphenol A and hexabromocyclodecanes in multi-tissues of prey and predator fish from an e-waste site, South China. Environmental Science and Pollution Research 22(16):12011-12017.		
HERO ID:		3350534		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods (e.g., collecting, dissection, and storage conditions) were adequately described.
	Metric 2:	Analytical Methodology	Medium	Key analytical methods were reported, including a reference to previously published protocol. However, MDLs were only reported as a range. (Presumably they varied based on the type of fish muscle).
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in fish.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Sampling was done in south China.
	Metric 5:	Currency	Medium	Samples were collected in 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	Ten fishes and 12 tissue samples from each fish species were collected without replicates. Some tissue types were pooled together because of low mass for a total of 57 tissue samples.
	Metric 7:	Exposure Scenario	High	Fishes were collected from a known e-waste recycling area that contaminated a natural pond.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported. Means and averages by fish species and tissue type were provided in Results.
	Metric 9:	Quality Assurance	High	QA/QC methods included procedural blanks, spiked blanks, spiked matrices, and recoveries (acceptable).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Gaps and limitations were not reported. Variance was only weakly characterized with range in pg 12013.
Overall Quality Determination			High	

Study Citation:		Lee, I. S., Kang, H. H., Kim, U. J., Oh, J. E. (2015.0). Brominated flame retardants in Korean river sediments, including changes in polybrominated diphenyl ether concentrations between 2006 and 2009. Chemosphere 126:18-24.		
HERO ID:		3350542		
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	South Korea
	Metric 5:	Currency	Medium	Samples collected between 2006 and 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	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			High	

Study Citation:		Nakao, T., Akiyama, E.,ma, Kakutani, H., Mizuno, A., Aozasa, O., Akai, Y., Ohta, S. (2015.0). Levels of tetrabromobisphenol A, tribromobisphenol A, dibromobisphenol A, monobromobisphenol A, and bisphenol A in Japanese breast milk. Chemical Research in Toxicology 28(4):722-728.		
HERO ID:		3350553		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Some information missing such as amount of milk collected and container material, which may impact the results.
	Metric 2:	Analytical Methodology	High	Analytical instrumentation and methods are described in good detail, including extraction method, analyte derivatization, and instrument calibration. LOQ is reported.
	Metric 3:	Biomarker Selection	N/A	This study is testing for the parent chemical of interest in breast milk, which is environmental media relative to the population of concern (breastfed infants).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected from individuals living in Osaka, Japan.
	Metric 5:	Currency	Medium	Samples were collected between December 2012 and June 2013.
	Metric 6:	Spatial and Temporal Variability	Medium	Breast milk samples were collected from 19 donors; three samples were collected per donor, at 1 week, one month, and three months after birth. An additional series of samples was collected every three to six hours for 24 hours starting one week after delivery from two donors. However, use of replicates is not reported.
	Metric 7:	Exposure Scenario	High	The media of interest is breastmilk of women who have recently given birth, which is a highly relevant exposure scenario for breastfed infants.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported; concentrations were reported as means and standard deviations of three independent analyses per individual. Concentrations of samples collected 1 week after birth are tabulated, but results at 1 month and 3 months are only presented graphically, with standard deviations for each mean not specified. Results for the 24-hour collection series are only reported graphically with neither means nor standard deviations specified.
	Metric 9:	Quality Assurance	Medium	Analyses were performed in triplicate. Concentrations for the target analyte of interest were corrected with the recovery efficiency of an internal standard. Samples for all analytes were reported to have high internal standard recoveries "in the range of 60-120%" but not further specified for the analyte of interest; reporting specific recovery values would merit a high score.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability is characterized both quantitatively and qualitatively by standard deviation and by assessing concentration over time. However, discussion of limitations or potential sources of uncertainty is absent.
Overall Quality Determination			Medium	

Study Citation:		Akiyama, E.,ma, Kakutani, H., Nakao, T., Motomura, Y., Takano, Y., Sorakubo, R., Mizuno, A., Aozasa, O., Tachibana, K., Doi, T., Ohta, S. (2015.0). Facilitation of adipocyte differentiation of 3T3-L1 cells by debrominated tetrabromobisphenol A compounds detected in Japanese breast milk. Environmental Research 140:157-164.		
HERO ID:		3350557		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling equipment (including storage medium) and procedures were not specified. The information on sampling methodology included sample storage and sample collection timing (3 samples collected per participant in one day, one month after delivery, and the samples were stored at -20 C until analysis).
	Metric 2:	Analytical Methodology	High	Key analytical methods, including LOQ, were reported. Recoveries were determined and factored in. Appropriate biomarkers were evaluated, both TBBPA and its debrominated forms.
	Metric 3:	Biomarker Selection	High	Appropriate biomarkers were evaluated in human milk, both TBBPA and its debrominated congeners.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Japan
	Metric 5:	Currency	Medium	Samples were collected between 2011 and 2013.
	Metric 6:	Spatial and Temporal Variability	Medium	There were 12 samples, but no replicates. Milk was collected 3x per person, over one day, 1 month after delivery.
	Metric 7:	Exposure Scenario	Medium	Exposure sources were not well characterized, but the data closely represent relevant/realistic exposure scenarios. There were no exposure controls, as would be expected for a ubiquitous chemical.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data were included (Table 1), along with means, maxima, and minima. SD is not reported, but could be derived from the raw data.
	Metric 9:	Quality Assurance	High	Recoveries were used to correct concentrations. Standards were used as laboratory control samples. It was not possible to secure pre-exposure samples.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was alluded to, including the raw data. However, neither uncertainty nor variability were discussed directly, nor were study limitations. The study evaluated TBBPA and debrominated congeners of TBBPA. There was also an experimental element of this study, evaluating certain effects of these chemicals.
Overall Quality Determination			High	

Study Citation:	Lu, Z.,he, Letcher, R. J., Chu, S., Ciborowski, J., Haffner, G. D., Drouillard, K., Macleod, S. L., Marvin, C. H. (2015.0). Spatial distributions of polychlorinated biphenyls, polybrominated diphenyl ethers, tetrabromobisphenol A and bisphenol A in Lake Erie sediment. Journal of Great Lakes Research 41(3):808-817.			
HERO ID:	3351237			
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods were reported.
	Metric 2:	Analytical Methodology	High	Analytical methods were described in detail.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in Lake Erie sediment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Lake Erie (US / Canada)
	Metric 5:	Currency	Low	Samples were collected in 2004.
	Metric 6:	Spatial and Temporal Variability	Medium	46 surficial sediment sample and 10 deeper ones were collected without replicates.
	Metric 7:	Exposure Scenario	Medium	The continued presence of TBBPA in the environment and its release from old products as sources of contamination in Lake Erie was discussed. This is relevant to aquatic organisms and populations that use the lake.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	TBBPA was not detected in almost all of the samples. When it was detected in two of the sediments, concentrations were provided in text.
	Metric 9:	Quality Assurance	High	Key QA reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variance is not relevant to this study because only two samples detected TBBPA, one of which was not quantifiable. Limitations were not discussed.
Overall Quality Determination			High	

Study Citation:		Liu, A. F., Qu, G. B., Yu, M., Liu, Y. W., Shi, J. B., Jiang, G. B. (2016.0). Tetrabromobisphenol-A/S and nine novel analogs in biological samples from the Chinese Bohai Sea: Implications for trophic transfer. Environmental Science & Technology 50(8):4203-4211.		
HERO ID:		3351552		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling protocol used was not a publicly available SOP from a trusted or authoritative source, but the sampling methodology is appropriate (i.e., scientifically sound). However, the sampling equipment and procedure and sample storage duration are not described. Additionally, while the study sites are reported, they are not well characterized.
	Metric 2:	Analytical Methodology	High	The analytical method used was not a publicly available method from a trusted or authoritative source, but the methodology is clear and appropriate (i.e., scientifically sound). Instrument detection limits (IDL), instrument quantification limits (IQL), MDL, and MQL are reported in Table S2.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in biological media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected from five coastal areas of the Chinese Bohai Sea, China.
	Metric 5:	Currency	Medium	Samples were collected in July and November of 2012.
	Metric 6:	Spatial and Temporal Variability	High	Replicate samples were collected. A total of 97 biological samples (5 phycophyta species, 2 zooplankton species, 14 invertebrate species, and 13 fish species) were collected.
	Metric 7:	Exposure Scenario	Medium	The data likely represent relevant/realistic exposure scenario, but the use of expose controls was not described.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported. Summary statistics (detection frequency, mean, median, concentration range) were reported in Tables 3 and S1.
	Metric 9:	Quality Assurance	Medium	The use of QA/QC techniques and results were described such as the use of procedural blanks, matrix effects determination, checks for potential interference and cross-contamination, and recoveries. However, baseline samples were not reported. Table S2 reports recoveries and matrix effects.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The study characterizes variability in the population/media studied by investigating 5 different sites and 34 different species. No standard deviation is provided. The study has limited discussion of key uncertainties, limitations, and data gaps.
Overall Quality Determination			Medium	

Study Citation:		Schwarz, S., Rackstraw, A., Behnisch, P. A., Brouwer, A., Koehler, H. R., Kotz, A., Kuballa, T., Malisch, R., Neugebauer, F., Schilling, F., Schmidt, D., von Der Trenck, K. T. (2016.0). Peregrine falcon egg pollutants Mirror Stockholm POPs list including methylmercury. Toxicological and Environmental Chemistry 98(8):886-923.		
HERO ID:		3449771		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methods were not described well. Failed wild peregrine falcon eggs were collected by amateur ornithologists, in the process of "caring for" breeding wild peregrine falcon pairs. Storage of eggs is not discussed, and study site characteristics are not described.
	Metric 2:	Analytical Methodology	Medium	GC-EC-MS. Not all samples were analyzed by the same lab. For a description of methods, readers are referred to other publications. The LOQ were provided for each chemical, time period, and lab.
	Metric 3:	Biomarker Selection	N/A	Parent substances were measured in the egg contents.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Germany
	Metric 5:	Currency	Medium	2006-2011
	Metric 6:	Spatial and Temporal Variability	Medium	Number of samples per year is shown in Figure 9 and ranged from 8 - 23. No replicates were reported.
	Metric 7:	Exposure Scenario	High	Samples were from peregrine falcon eggs.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data are not provided. Means are shown in Figure 9 [need to digitize], but it is difficult to read the TBBPA data, especially for 2006-2008, which is not discussed in the text where the 2009 to 2011 data are discussed. Other summary statistics are missing.
	Metric 9:	Quality Assurance	Low	QA/QC is not discussed, except to note that the lab that analyzed samples from 2001 - 2008 checked the analyte recovery through the whole procedure by spiking the samples with 13C-PCB-101. Methods were not discussed in detail in this paper, but were laid out in other papers.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not discussed, and there were no obvious sources of uncertainty. There is a passing reference to collection of eggs occurring at varying intervals after they were laid.
Overall Quality Determination			Medium	

Study Citation:		Aznar-Alemany, Ò., Trabalón, L., Jacobs, S., Barbosa, V. L., Tejedor, M. F., Granby, K., Kwadijk, C., Cunha, S. C., Ferrari, F., Vandermeersch, G., Sioen, I., Verbeke, W., Vilavert, L., Domingo, J. L., Eljarrat, E., Barceló, D. (2016.0). Occurrence of halogenated flame retardants in commercial seafood species available in European markets. Food and Chemical Toxicology 104:35-47.		
HERO ID:		3454553		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methods not reported such as sample storage conditions and sampler calibration.
	Metric 2:	Analytical Methodology	Medium	Key analytical methods reported.
	Metric 3:	Biomarker Selection	N/A	Parent chemical measured in the environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in several European countries.
	Metric 5:	Currency	High	Samples collected between 2014 and 2015.
	Metric 6:	Spatial and Temporal Variability	Medium	More than 10 samples collected, no replicates were reported.
	Metric 7:	Exposure Scenario	Medium	Exposure source was not well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data was not reported.
	Metric 9:	Quality Assurance	Medium	Limited QA was reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some gaps and limitations were reported.
Overall Quality Determination			Medium	

Study Citation:		Moreau-Guigon, E., Alliot, F., Gasperi, J., Blanchard, M., Teil, M. J., Mandin, C., Chevreuil, M. (2016.0). 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:		Han, W., Wang, S., Huang, H., Luo, L., Zhang, S. (2013.0). Simultaneous determination of brominated phenols in soils. Journal of Environmental Sciences 25(11):2306-2312.		
HERO ID:		3494100		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling approaches described
	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	China
	Metric 5:	Currency	Low	Study published in 2013
	Metric 6:	Spatial and Temporal Variability	Medium	5 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	QA reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Few gaps and limitations reported
Overall Quality Determination			Medium	

Study Citation:		Kim, U. J., Lee, I. S., Oh, J. E. (2016.0). Occurrence, removal and release characteristics of dissolved brominated flame retardants and their potential metabolites in various kinds of wastewater. Environmental Pollution 218:551-557.		
HERO ID:		3545985		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods (e.g., site characteristics in Table 1 and Figure S1, equipment, storage conditions) were reported.
	Metric 2:	Analytical Methodology	Medium	Most pertinent analytical methods (e.g., extraction, instrumentation, and analytical methods plus references to previously published protocols) were reported. However, LOQ was only reported as a range from 0.03-0.3 ng/L.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in the environment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Ulsan and Busan, South Korea
	Metric 5:	Currency	Medium	Samples were collected during June-December 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	Three samples were collected from each of five WWTPs. Four sets of samples were collected from one sewage treatment plant and one human waste treatment plant. That gives a total of 23 samples for the plants themselves. In addition, to investigate the effects of discharged water on river water quality, 13 samples were collected from select treatment plants. Replicates were not reported.
	Metric 7:	Exposure Scenario	High	TBBPA levels in water treatment plants are relevant. Exposure source was characterized in Table 1 and Section 3.1 (pg 554).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported. Summary statistics (e.g., mean, median, min, max, std) were presented in Table S1 by treatment plant type.
	Metric 9:	Quality Assurance	Medium	The recovery range for TBBPA was 64.3-121.2%. The lower bound is <70%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some gaps and limitations, albeit limited, were reported in Results and Discussion.
Overall Quality Determination			Medium	

Study Citation:		Li, F., Jin, J., Tan, D., Wang, L., Geng, N., Cao, R., Gao, Y., Chen, J. (2016.0). Hexabromocyclododecane and tetrabromobisphenol A in sediments and paddy soils from Liaohe River Basin, China: Levels, distribution and mass inventory. Journal of Environmental Sciences 48:209-217.		
HERO ID:		3546008		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling method described and 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	China
	Metric 5:	Currency	Medium	Samples collected in 2010
	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 reported in figures
	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:		Frederiksen, M., Vorkamp, K., Bossi, R., Riget, F., Dam, M., Svensmark, B.,o (2007.0). Method development for simultaneous analysis of HBCD, TBBPA, and dimethyl-TBBPA in marine biota from Greenland and the Faroe Islands. International Journal of Environmental Analytical Chemistry 87(15):1095-1109.		
HERO ID:		3575380		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Acceptable sampling methods described in detail elsewhere, Vorkamp et al., 2007 and Vorkamp et al., 2004. Missing description of how samples were collected from animals and transported. Samples were pooled, no description of the method.
	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	Faroe Islands
	Metric 5:	Currency	Low	Study published in 2007; no date of data collection
	Metric 6:	Spatial and Temporal Variability	Low	<10 animals were sampled and included in pooled; typically pools of five subsamples, no replicates
	Metric 7:	Exposure Scenario	Low	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	Low	Few gaps and limitations reported
Overall Quality Determination			Low	

Study Citation:		Gallistl, C., Lok, B., Schlien, A., Vetter, W. (2017.0). Polyhalogenated compounds (chlorinated paraffins, novel and classic flame retardants, POPs) in dishcloths after their regular use in households. Science of the Total Environment 595(1):303-314.		
HERO ID:		3828894		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods reported
	Metric 2:	Analytical Methodology	High	Analytical methods described, LOD and recoveries reported in SI
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Germany
	Metric 5:	Currency	High	Samples collected in 2015
	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	Key QA reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some limitations reported
Overall Quality Determination			High	

Study Citation:		Ho, K. L., Yuen, K. K., Yau, M. S., Murphy, M. B., Wan, Y., Fong, B. M. W., Tam, S., Giesy, J. P., Leung, K. S., Lam, M. H. (2017.0). Glucuronide and sulfate conjugates of tetrabromobisphenol A (TBBPA): Chemical synthesis and correlation between their urinary levels and plasma TBBPA content in voluntary human donors. Environment International 98:46-53.		
HERO ID:		3843987		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling information not reported such sample storage conditions/duration and sampler calibration.
	Metric 2:	Analytical Methodology	High	Key analytical methods reported. High score selected for plasma because MDL is reported, however the score for urine is medium because no MDL for TBBPA (parent form) is reported.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media. Study also tested for TBBPA conjugates in urine.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Hong Kong
	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 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/QC measures reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported.
Overall Quality Determination			Medium	

Study Citation:		Besis, A., Christia, C., Poma, G., Covaci, A., Samara, C. (2017.0). Legacy and novel brominated flame retardants in interior car dust---Implications for human exposure. Environmental Pollution 230:871-881.		
HERO ID:		3860936		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods were reported, including references to previously published methods.
	Metric 2:	Analytical Methodology	High	Key analytical methods were reported, including instrumentation, LOQs, recoveries, and sample extraction.
	Metric 3:	Biomarker Selection	N/A	Study measured parent compound in car dust.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was conducted in Greece.
	Metric 5:	Currency	High	Samples were collected in 2016, but note that cars were manufactured between 1997 and 2015.
	Metric 6:	Spatial and Temporal Variability	Medium	Samples were collected from 30 private vehicles without replicates.
	Metric 7:	Exposure Scenario	High	Exposure source to TBBPA from its use in car materials via interior dust is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data were reported in Table S3. Table 1 provides detection frequency, mean, median, min, and max.
	Metric 9:	Quality Assurance	Medium	QA/QC was discussed. Authors reported that the recoveries of labeled internal standards for HBCD and TBBPA was between 50 and 75%. It is unclear where TBBPA's recovery falls in that range, but could be low.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Only limitation reported pertained to a small amount of sample available, thus reducing the number of samples analyzed for TBBPA from 30 to 25. Other limitations pertained to estimating doses and not the monitoring data.
Overall Quality Determination			High	

Study Citation:		Tay, J. H., Sellström, U., Papadopoulou, E., Padilla-Sánchez, J. A., Haug, L. S., de Wit, C. A. (2017.0). Human exposure to legacy and emerging halogenated flame retardants via inhalation and dust ingestion in a Norwegian cohort. Environmental Science & Technology 51(14):8176-8184.		
HERO ID:		3861571		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methods were not reported such as sample storage conditions.
	Metric 2:	Analytical Methodology	High	Analytical methods were reported in great detail. Table S7 contains the LOD/LOQs.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in dust and stationary and personal air.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Norway.
	Metric 5:	Currency	Medium	Samples were collected between 2013 and 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	Dust and stationary air samples were collected from 61 households, in addition to 13 personal air samples from adults residents. There were no replicates reported.
	Metric 7:	Exposure Scenario	High	Exposure to TBBPA via indoor air and dust is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	Medium	QA/QC reported. Recoveries are provided in Table S6. The lower bound of the mean recovery is <70%, and no corrections were discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Gaps and limitations were not reported.
Overall Quality Determination			Medium	

Study Citation:		Kotthoff, M., Rüdél, H., Jürling, H. (2017.0). Detection of tetrabromobisphenol A and its mono- and dimethyl~derivatives in fish, sediment and suspended particulate matter from European freshwaters and estuaries. Analytical and Bioanalytical Chemistry 409(14):3685-3694.		
HERO ID:		3864819		
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	Several European countries
	Metric 5:	Currency	Medium	Samples collected between 2007 and 2013
	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 not reported
	Metric 9:	Quality Assurance	Medium	Some QA reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported
Overall Quality Determination			High	

Study Citation:		Liu, A., Shi, J., Qu, G., Hu, L., Ma, Q., Song, M., Jing, C., Jiang, G. (2017.0). Identification of emerging brominated chemicals as the transformation products of tetrabromobisphenol A (TBBPA) derivatives in soil. Environmental Science & Technology 51(10):5434-5444.		
HERO ID:		3974691		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Soil samples (Fig S1) collected with a stainless steel scoop at surface (0-5cm) and beneath (30-40cm), freeze-dried, filtered, and stored -20C.
	Metric 2:	Analytical Methodology	High	Extracted with DCM/acetone (Sec 2.3) and analyzed with mass spectrometry (Sec 2.5). Recoveries were reported. MDLs provided in Table S3.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in sediment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Shouguang, China
	Metric 5:	Currency	Low	Sampling date was not provided. Paper was published 2017.
	Metric 6:	Spatial and Temporal Variability	Medium	84 soil samples were collected from 42 sampling sites. Timing was not provided, and replicates were not reported.
	Metric 7:	Exposure Scenario	Medium	TBBPA concentrations from soil samples around three brominated flame retardant production plants in China is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data are available in Table S4, but summary statistics were mostly missing.
	Metric 9:	Quality Assurance	High	Recoveries ranged from 78-95%. All experiments were performed in triplicate with blank and spiked samples.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variance was not characterized and no limitations were discussed.
Overall Quality Determination			Medium	

Study Citation:	Daso, A. P., Rohwer, E. R., Koot, D. J., Okonkwo, J. O. (2017.0). Preliminary screening of polybrominated diphenyl ethers (PBDEs), hexabromocyclododecane (HBCDD) and tetrabromobisphenol A (TBBPA) flame retardants in landfill leachate. Environmental Monitoring and Assessment 189(8):418.			
HERO ID:	3975076			
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	24 samples were collected from 8 landfill sites (coordinates in Table 1), stored in bottles, and kept cool en-route to the laboratory. The sampling equipment and number of samples per site were not provided.
	Metric 2:	Analytical Methodology	Low	Methods that were described included SPE, ultra-performance liquid chromatography time-of-flight mass spectrometry, and recoveries. Detection limits were not defined.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in landfill leachate.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected from Pretoria, Johannesburg, Gauteng Province, South Africa.
	Metric 5:	Currency	Medium	Samples were collected between May - July 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	24 samples were collected during the winter season (May-July) from eight locations. It is unclear if triplicates were collected.
	Metric 7:	Exposure Scenario	Medium	The concentration in leachate from landfills in South Africa was measured. Authors did not mention if the specific landfill studied has the potential to migrate to GW that is a drinking water source.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 2 provides mean, %RSD, and range per site but not raw data.
	Metric 9:	Quality Assurance	Low	QA/QC described reagents, procedural blanks, and other techniques. Recovery was <70% and no methods were taken to correct for it.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No limitations or uncertainties were described.
Overall Quality Determination			Medium	

Study Citation:		Shi, Z., Zhang, L., Zhao, Y., Sun, Z., Zhou, X., Li, J., Wu, Y. (2017.0). Dietary exposure assessment of Chinese population to tetrabromobisphenol-A, hexabromocyclododecane and decabrominated diphenyl ether: Results of the 5th Chinese total diet study. Environmental Pollution 229:539-547.		
HERO ID:		3975096		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods were reported, including site characteristics.
	Metric 2:	Analytical Methodology	High	Sample preparation, instrumentation, and LOQs are all in the supplemental.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in food.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in China.
	Metric 5:	Currency	Medium	Authors noted that the current Total Dietary Study, which this study is a part of, was performed in 2011.
	Metric 6:	Spatial and Temporal Variability	Medium	80 samples were collected without replicates.
	Metric 7:	Exposure Scenario	High	Exposure to the "standard Chinese man" through the consumption of various food groups that are potentially contaminated by China's industrial activity is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	High	QA/QC was adequately described.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Standard deviations were reported, but not gaps and limitations.
Overall Quality Determination			High	

Study Citation:		Dufour, P., Pirard, C., Charlier, C. (2017.0). Determination of phenolic organohalogens in human serum from a Belgian population and assessment of parameters affecting the human contamination. Science of the Total Environment 599-600:1856-1866.		
HERO ID:		3983917		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods reported and additional references reported
	Metric 2:	Analytical Methodology	High	Key analytical methods reported and additional reference reported.
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Province of Liege, Belgium
	Metric 5:	Currency	High	Samples collected in 2015
	Metric 6:	Spatial and Temporal Variability	Medium	n=274; no replicates
	Metric 7:	Exposure Scenario	High	Exposure through fish and seafood intake
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported
	Metric 9:	Quality Assurance	High	Key QA/QC reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability and limited uncertainty discussed.
Overall Quality Determination			High	

Study Citation:		Xiong, J., Li, G., An, T., Zhang, C., Wei, C. (2016.0). Emission patterns and risk assessment of polybrominated diphenyl ethers and bromophenols in water and sediments from the Beijiang River, South China. Environmental Pollution 219:596-603.		
HERO ID:		3984783		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Most sampling methods were reported, such as site characteristics, equipment, and collection date. Missing information included overall lack of details on sampling regimen (e.g., sampling frequency) and storage conditions.
	Metric 2:	Analytical Methodology	High	Key analytical methods were reported in both the main paper and SI. Detection limits are in Table S2.
	Metric 3:	Biomarker Selection	N/A	Study tested for parent chemical in river water and sediment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected from the Beijiang River in southern China.
	Metric 5:	Currency	Medium	Samples collected in 2014
	Metric 6:	Spatial and Temporal Variability	Medium	15 samples were collected for each water and sediment without any reporting of replicates.
	Metric 7:	Exposure Scenario	High	Exposure scenario was characterized, including exposure source from two electronic waste dismantling regions upstream of river and its flow through "urban, rural, industrialized, and less-industrialized areas."
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were reported in Tables S6 and S7, but summary statistics other than the mean were mostly missing.
	Metric 9:	Quality Assurance	High	QA/QC was reported in both main text and SI.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Gaps and limitations were not reported. Variance only characterized by range, but raw data are available.
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. (2016.0). 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 an 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	Medium	Results not clearly presented. No raw data.
	Metric 9:	Quality Assurance	Low	states "analyzed according to validated methods"
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited discussion of variability and uncertainty
Overall Quality Determination			Medium	

Study Citation:		Tao, L., Wu, J. P., Zhi, H., Zhang, Y., Ren, Z. H., Luo, X. J., Mai, B. X. (2016.0). Aquatic bioaccumulation and trophic transfer of tetrabromobisphenol-A flame retardant introduced from a typical e-waste recycling site. Environmental Science and Pollution Research 23(14):14663-14670.		
HERO ID:		3986061		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Acceptable sampling methods
	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	South China, but specific e-waste site is not reported
	Metric 5:	Currency	Medium	Samples collected in 2007
	Metric 6:	Spatial and Temporal Variability	Medium	Between 3-10 samples per organism; no replicate sites; no temporal variability
	Metric 7:	Exposure Scenario	High	Exposure source characterized
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported; summary statistics 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:		Gu, S. Y., Ekpeghere, K. I., Kim, H. Y., Lee, I. S., Kim, D. H., Choo, G., Oh, J. E. (2017.0). Brominated flame retardants in marine environment focused on aquaculture area: Occurrence, source and bioaccumulation. Science of the Total Environment 601-602:1182-1191.		
HERO ID:		3986237		
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	South Korea
	Metric 5:	Currency	High	Samples collected in 2015 and 2016
	Metric 6:	Spatial and Temporal Variability	High	>10 samples; 20-30 oysters and mussels, water and sediments from various sites unclear if replicates were collected.
	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			High	

Study Citation:		Cunha, S. C., Oliveira, C., Fernandes, J. O. (2017.0). Development of QuEChERS-based extraction and liquid chromatography-tandem mass spectrometry method for simultaneous quantification of bisphenol A and tetrabromobisphenol A in seafood: Fish, bivalves, and seaweeds. Analytical and Bioanalytical Chemistry 409(1):151-160.		
HERO ID:		4141787		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sardine, mussel, canned tuna, canned sardine, and canned mackerel samples randomly collected in local markets; dried seaweeds purchased from organic grocery; all edible content pooled, homogenized with a grinder and frozen at -80C; then freeze dried 48 h and maintained at 4C until anlysis
	Metric 2:	Analytical Methodology	High	liquid–liquid extraction (LLE); LC-MS/MS; recoveries; LOD and LOQ provided in Table 2
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Porto, Portugal
	Metric 5:	Currency	Low	Does not provided a sampling date; published 2016
	Metric 6:	Spatial and Temporal Variability	Medium	25 specimens; n for results not clear/specified
	Metric 7:	Exposure Scenario	Medium	concentration in different wild and canned samples of fish, mussel, and seaweed
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	concentrations provided in "Application" section starting on p. 158; provides levels of detections per species or food type
	Metric 9:	Quality Assurance	High	Recoveries and inter-day repeatability provided in Table 2
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Compare results with previous studies
Overall Quality Determination			Medium	

Study Citation:		Oberg, K., Warman, K., Oberg, T. (2002.0). Distribution and levels of brominated flame retardants in sewage sludge. Chemosphere 48(8):805-809.		
HERO ID:		4160025		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methodology is only briefly discussed, therefore, most sampling information is missing such as sampling equipment and procedure, sample storage conditions/duration, sampler calibration, and study site characteristics.
	Metric 2:	Analytical Methodology	Low	LOQ, LOD, detection limits, and/or reporting limits not reported.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Sweden
	Metric 5:	Currency	Low	Samples collected between 1999 and 2000.
	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/QC measures reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Few data gaps and limitations reported.
Overall Quality Determination			Low	

Study Citation:		Wang, J., Liu, L., Wang, J., Pan, B., Fu, X., Zhang, G., Zhang, L., Lin, K. (2015.0). Distribution of metals and brominated flame retardants (BFRs) in sediments, soils and plants from an informal e-waste dismantling site, South China. Environmental Science and Pollution Research 22(2):1020-1033.		
HERO ID:		4161193		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methods documented included sampling equipment and sample storage conditions (but not storage duration). It is not clear what portions of the plants were collected, or if they used entire plants. Sampler calibration is not mentioned, but that seems not applicable to the sampling techniques employed.
	Metric 2:	Analytical Methodology	High	Key analytical methods (including extraction techniques) were reported, including recoveries obtained. The LOD was also identified.
	Metric 3:	Biomarker Selection	N/A	Samples were for parent chemicals in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Longtang, China
	Metric 5:	Currency	Medium	Samples were collected in 2012.
	Metric 6:	Spatial and Temporal Variability	High	There were 14 sediment samples, 22 soil samples, and 20 plant samples. Two to three samples were collected from each location for any given media sampled (see Table S1). For soil and sediment, these would have served as replicates, so I rated this metric as high. Note that 2 different types of plants were sampled (in each location, it sounds like), so those would not have served as replicates for plant samples.
	Metric 7:	Exposure Scenario	High	This is a relevant exposure scenario, and the exposure sources were characterized, including analysis of e-waste samples. Sample S1 was intended to be a pre-exposure control, upstream of the discharge of the e-waste dismantling sites.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were shown in a figure, which provides only approximate values. Summary statistics were not well-identified. There is a single value reported, which was probably the mean, followed by a range in parentheses, which likely indicate the minimum and maximum detections. SD was not reported. The text notes TBBPA was detected in all sediment and soil samples.
	Metric 9:	Quality Assurance	High	Key QA methods were reported, including testing of recoveries and blanks. A baseline sampling site upstream of the e-waste site was included (Site S1).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The paper alluded to uncertainties related to the fate and transport of TBBPA. Variability across the samples (and compared to results from other investigations) is briefly mentioned. However, few gaps and limitations were reported.
Overall Quality Determination			High	

Study Citation:		Jakobsson, K., Thuresson, K., Rylander, L., Sjödin, A., Hagmar, L., Bergman, A. (2002.0). Exposure to polybrominated diphenyl ethers and tetrabromobisphenol A among computer technicians. Chemosphere 46(5):709-716.		
HERO ID:		4161906		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods were explained thoroughly and were scientifically sound. The only missing piece of information was how long samples were stored, but they were stored at -20 C until analysis.
	Metric 2:	Analytical Methodology	High	Detailed analytical methods (including calibration and extraction methods) were provided, along with the LOD and LOQ. Concentrations were measured on a lipid weight basis.
	Metric 3:	Biomarker Selection	High	The biomarker is the chemical of interest in blood.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Sweden
	Metric 5:	Currency	Low	Sampling was in 1999.
	Metric 6:	Spatial and Temporal Variability	Medium	There were no replicate samples While there were 19 samples, concentration data for TBBPA was only available from 10 because of blank interference and a higher LOQ for half the samples. Since TBBPA has a short half-life, the sampling approach likely captures variability in the population of interest.
	Metric 7:	Exposure Scenario	High	Data closely represent a relevant exposure scenario. Sources of exposure were captured. However, the "control" population of cleaners who never used computers and of computer clerks was only sampled (in a prior year) for PDBEs, but not TBBPA, so there were no exposure controls for TBBPA. However, this would be unlikely to have a substantial impact on the characterization of the exposure scenario.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported; the only summary statistics provided were the median, range, and number of samples above the LOD and LOQ.
	Metric 9:	Quality Assurance	Medium	The study included only limited description of QA/QC techniques, which included use of blanks and accounting for blank interference. It appears the authors did not calculate recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The paper included limited characterization of variability, but did not discuss uncertainties and limitations. For example, there was no commentary about the fact that they were only able to quantify the level of TBBPA in 4 of 10 samples, although it was detected in 8 of 10 samples, resulting in a small pool of data.
Overall Quality Determination			Medium	

Study Citation:		Zheng, X., Sun, R., Qiao, L., Guo, H., Zheng, J., Mai, B. (2017.0). Flame retardants on the surface of phones and personal computers. Science of the Total Environment 609:541-545.		
HERO ID:		4162077		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	There was a brief description of wipe sampling. There is no method number or reference provided. The storage conditions were mentioned and blanks were collected.
	Metric 2:	Analytical Methodology	Medium	Analytical methodology is provided and a reference with the analytical parameters is cited
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical only
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Guangzhou, China
	Metric 5:	Currency	High	Samples were collected in June 2015
	Metric 6:	Spatial and Temporal Variability	Low	There were 4-13 samples collected per type of phone/PC. No replicated were reported.
	Metric 7:	Exposure Scenario	High	Data represents exposure to indoor air.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported. Several summary statistics were reported, including detection freq, median, and range provided for data sets of 1) phones and 2) PCs. Fig.1 provides a graphical representation of concentration by brand of phone
	Metric 9:	Quality Assurance	Medium	Key QA reported included use of blanks. Spiked samples were analyzed but results not provided with no issues being identified
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Median & range provided but variation not tabulated for data set. No replicated were reported. The limitations section states that it is a preliminary study with further work to be done.
Overall Quality Determination			Medium	

Study Citation:		Zacs, D., Rjabova, J., Ikkere, L. E., Bavrins, K., Bartkevics, V. (2018.0). Brominated flame retardants and toxic elements in the meat and liver of red deer (Cervus elaphus), wild boar (Sus scrofa), and moose (Alces alces) from Latvian wildlife. Science of the Total Environment 621:308-316.		
HERO ID:		4162092		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling sites, equipment, method, and storage conditions all described.
	Metric 2:	Analytical Methodology	Low	Extraction, sample preparation, analytical methods, calibration curves, and instrument reported. Missing LOD, but additional reference is cited (Zacs et al., 2015). LOD is only reported for cadmium.
	Metric 3:	Biomarker Selection	N/A	Testing for parent compound in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Latvia
	Metric 5:	Currency	High	Samples collected in 2016.
	Metric 6:	Spatial and Temporal Variability	Medium	9 boar, 7 moose, 8 deer samples (24 total). No replicates.
	Metric 7:	Exposure Scenario	High	Measuring TBBPA in animal muscle and liver.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data reported in table S5-S10. Min, max, mean, and detection frequency reported in table S4.
	Metric 9:	Quality Assurance	High	Procedural blanks and quality control samples were included in the routine quality control (QC) protocol and were analyzed in each sample sequence. Recoveries were all above 75%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability characterized in the sampling of different species of animals, age of animals, sites, date, and tissue type. Limitations not reported.
Overall Quality Determination			High	

Study Citation:		Zhang, X. L., Luo, X. J., Chen, S. J., Wu, J. P., Mai, B. X. (2009.0). Spatial distribution and vertical profile of polybrominated diphenyl ethers, tetrabromobisphenol A, and decabromodiphenylethane in river sediment from an industrialized region of South China. Environmental Pollution 157(6):1917-1923.		
HERO ID:		4162106		
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	Dongjiang River, South China
	Metric 5:	Currency	Medium	Samples collected in 2006
	Metric 6:	Spatial and Temporal Variability	Medium	>10 surface sediment samples were collected across river/stream networks without sample replicates for individual sites. 2 cores were collected to quantify concentrations with sediment depth as a proxy for temporal patterns.
	Metric 7:	Exposure Scenario	Medium	Exposure source not well characterized
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data for the surface sediment samples are reported in Table 1, but the raw data for core measurements with depth are not reported (they are visualized in Figure 3).
	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:		Osako, M., Kim, Y. J., Sakai, S. (2004.0). Leaching of brominated flame retardants in leachate from landfills in Japan. Chemosphere 57(10):1571-1579.		
HERO ID:		4163235		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Besides detailed site characteristics, the only other information provided on sampling was that a raw and treated leachate sample were taken and "Twenty liters of each sample were put into a stainless steel vessel, which was stored in a shaded cold storageroom until pretreatment for BFRs analysis."
	Metric 2:	Analytical Methodology	Low	LODs were not reported.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in landfill leachate.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was conducted in Japan.
	Metric 5:	Currency	Low	Paper was published in 2004. No sampling date was provided.
	Metric 6:	Spatial and Temporal Variability	Medium	Twelves samples were collected without replicates.
	Metric 7:	Exposure Scenario	Medium	There is insufficient information on areas surrounding the landfills to determine which populations may be exposed.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics were not provided, but can be calculated from raw data in Table 3.
	Metric 9:	Quality Assurance	Low	QA/QC was not reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Data variance and limitations/uncertainties were not reported.
Overall Quality Determination			Low	

Study Citation:		Wang, J., Wang, Y., Shi, Z., Zhou, X., Sun, Z. (2017.0). Legacy and novel brominated flame retardants in indoor dust from Beijing, China: Occurrence, human exposure assessment and evidence for PBDEs replacement. Science of the Total Environment 618:48-59.		
HERO ID:		4168013		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methods not reported such as sample storage conditions and sampler calibration
	Metric 2:	Analytical Methodology	High	Key analytical methods reported
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Beijing, 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 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:		Han, T., Wu, M. H., Zang, C., Sun, R., Tang, L., Liu, N., Lei, J. Q., Shao, H. Y., Gu, J. Z., Xu, G. (2017.0). Hexabromocyclododecane and tetrabromobisphenol A in tree bark from different functional areas of Shanghai, China: Levels and spatial distributions. Environmental Science: Processes & Impacts 19(10):1346-1354.		
HERO ID:		4169006		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling protocol used was not a publicly available SOP from a trusted or authoritative source, but the sampling methodology is appropriate (i.e., scientifically sound). However, sample storage duration is not reported, and while the study sites are generally reported, they are not described in detail.
	Metric 2:	Analytical Methodology	Medium	The analytical method used was not a publicly available method from a trusted or authoritative source, but the methodology is clear and appropriate (i.e., scientifically sound). Instrument calibration was not discussed. LOD and LOQ reported in the text on page 1348.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media (tree bark).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Shanghai, China.
	Metric 5:	Currency	High	Samples were collected in December 2016.
	Metric 6:	Spatial and Temporal Variability	Medium	The collection of replicate samples was not reported. Twenty-nine samples were collected (industrial areas, n = 12; commercial areas, n = 8; residential areas, n = 9).
	Metric 7:	Exposure Scenario	Medium	The data may represent relevant/realistic exposure scenario (tree bark collected from different urban areas). The population of interest and use of exposure controls were not reported.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data were reported in Table S1. Summary statistics (medians and concentration ranges) were reported in the text on pages 1348-1349.
	Metric 9:	Quality Assurance	Medium	The use of QA/QC techniques and results were described such as blank samples, recovery samples, and technical duplicates. However, baseline samples were not reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The characterization of variability is absent (no measure of variance reported). The study has limited discussion of key uncertainties, limitations, and data gaps.
Overall Quality Determination			Medium	

Study Citation:		Song, S., Song, M., Zeng, L., Wang, T., Liu, R., Ruan, T., Jiang, G. (2014.0). Occurrence and profiles of bisphenol analogues in municipal sewage sludge in China. Environmental Pollution 186:14-19.		
HERO ID:		4181363		
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	China
	Metric 5:	Currency	Medium	Samples collected in 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	Analytical QA/QA described, more details in SI table S6
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported
Overall Quality Determination			High	

Study Citation:		Chu, S., Haffner, G. D., Letcher, R. J. (2005.0). Simultaneous determination of tetrabromobisphenol A, tetrachlorobisphenol A, bisphenol A and other halogenated analogues in sediment and sludge by high performance liquid chromatography-electrospray tandem mass spectrometry. Journal of Chromatography A 1097(1-2):25-32.		
HERO ID:		4181894		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	surface sediments (0-10cm and 10-20cm) collected from Lake Erie, stored at -20, then thawed; sewage effluent collected from WWTPs, centrifuged; study equipment not discussed; sampling procedure no further discussed SPE; PLC-ESI(–)-MS-MS; recoveries; MLOQ 0.05ng/g (Table 2) environmental media
	Metric 2:	Analytical Methodology	High	
	Metric 3:	Biomarker Selection	N/A	
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	sediment from Lake Erie and sewage effluents from the Little River WWTP and West Windsor Pollution Control Plant (Ontario, Canada) 2004
	Metric 5:	Currency	Low	
	Metric 6:	Spatial and Temporal Variability	Medium	55 surface sediment samples collected May-June; 3 sludge samples from Little River and 1 sample from West Windsor
	Metric 7:	Exposure Scenario	High	concentration in surface sediments from Lake Erie and sewage effluent samples from WWTP in Canada
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Now raw data provided.
	Metric 9:	Quality Assurance	High	methods validated by sediment samples spiked; recoveries 105%
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	compared effluent results to previous study
Overall Quality Determination			Medium	

Study Citation:		Qu, G., Liu, A., Wang, T., Zhang, C., Fu, J., Yu, M., Sun, J., Zhu, N., Li, Z., Wei, G., Du, Y., Shi, J., Liu, S., Jiang, G. (2013.0). Identification of tetrabromobisphenol A allyl ether and tetrabromobisphenol A 2,3-dibromopropyl ether in the ambient environment near a manufacturing site and in mollusks at a coastal region. Environmental Science & Technology 47(9):4760-4767.			
HERO ID:		4182078			
Domain	Metric	Rating	Comments		
Domain 1: Reliability	Metric 1:	Sampling Methodology	Medium	Some sampling conditions not well reported, such as sampling equipment, sampler calibration and the definition of surface soil (the maximum depth the soil samples were drawn from). Also, "All of the solid samples were freeze-dried;" but it's not clear how long they were stored before analysis.	
	Metric 2:	Analytical Methodology	High	Key analytical methods, including extraction, were reported in detail. They reported recoveries, LOD, LOQ, etc.	
	Metric 3:	Biomarker Selection	N/A	Parent chemicals and byproducts were measured in environmental samples.	
Domain 2: Representativeness	Metric 4:	Geographic Area	High	China	
	Metric 5:	Currency	Medium	Samples were collected in 2010.	
	Metric 6:	Spatial and Temporal Variability	Medium	There were 84 mollusk samples. There were six soil and sediment sampling sites; the study does not report how many samples were drawn from each site, but the text suggests it was one sample per site. Rice whole and earthworm were collected at four of the six sites; the study does not report how many samples were drawn from each site. Figure S-11 shows some of these data, by site; it suggests that it may have been one sample per site, since there was no mention of a mean concentration for each location. The paper made no mention of replicates.	
	Metric 7:	Exposure Scenario	High	The exposure source was a manufacturing plant, and samples were collected at different distances from the plant. One site, upstream of the plant, served as a control. Data represent relevant exposure scenarios.	
Domain 3: Accessibility/Clarity	Metric 8:	Reporting of Results	Medium	Raw data were not reported for all sample types, all chemicals, in all media. See Figure 2 for sediment and soil data and Figure 3 for mollusk data, broken down by city. See Figure S-11 for soil, rice hull, and earthworm samples analyzed for TBPPA AE and TBPPA DBDE. See tables S3 and S4 for mollusk data by species, analyzed for TBPPA AE and TBPPA DBDE.	
	Metric 9:	Quality Assurance	Low	There was no mention of using blanks. However, they attempted to have a site that represented control samples, upstream of the plant. Also, they calculated recoveries for three samples of each chemical in two different media, but did not correct for them. Recoveries of TBBPA in soil and sediment were 76% +/- 15, meaning they were as low as 61%. The range of recoveries for some of the other chemicals in multiple media also fell below 70%, in some instances. This drove the low rating for this metric. Recovery of TBBPA was too low in biological samples for TBBPA concentrations to be reported in rice hull, earthworms, or mollusks.	
Domain 4: Variability and Uncertainty		Metric 10:	Variability and Uncertainty	Medium	Some sources of variability and uncertainty were identified; few gaps and limitations were reported.
Overall Quality Determination			Medium		

Study Citation:		Luo, X. J., Zhang, X. L., Chen, S. J., Mai, B. X. (2010.0). Free and bound polybrominated diphenyl ethers and tetrabromobisphenol A in freshwater sediments. Marine Pollution Bulletin 60(5):718-724.		
HERO ID:		4182593		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	surface sediment samples (0-5cm) collected using a steel grab sampler; two sedimentary cores collected using gravity corer and sectioned at 4cm intervals; stored at -20 until extraction; sieved Soxhlet extraction; GC/MS; recoveries; MDI was 4.2 pg/g (p.720) environmental media
	Metric 2:	Analytical Methodology	High	
	Metric 3:	Biomarker Selection	N/A	
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	lower reaches of Dongjiang River, Pearl River Delta, Guangdong Province, South China October 2006 15 samples and 2 sedimentary cores collected in October; no replicate samples (Fig 1) free and bound concentration in surface sediments from river in China that runs through the largest electronics manufacturing region
	Metric 5:	Currency	Medium	
	Metric 6:	Spatial and Temporal Variability	Medium	
	Metric 7:	Exposure Scenario	High	
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Table 1 provides the free and bound concentrations per site sample duplicates; lab blanks; mean recovery was 80% (p. 720)
	Metric 9:	Quality Assurance	High	
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	compared results to other rivers in the world/other studies (p.721)
Overall Quality Determination			High	

Study Citation:		Thomsen, C., Leknes, H., Lundanes, E., Becher, G. (2002.0). A new method for determination of halogenated flame retardants in human milk using solid-phase extraction. Journal of Analytical Toxicology 26(3):129-137.		
HERO ID:		4183072		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Limited description of sampling methodology. Sampling equipment and procedure not reported.
	Metric 2:	Analytical Methodology	High	Analytical methodology is discussed in detail and is clear and appropriate.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Norway
	Metric 5:	Currency	Low	Samples from 2001.
	Metric 6:	Spatial and Temporal Variability	Low	9 samples pooled, no replicates.
	Metric 7:	Exposure Scenario	High	Data closely represent relevant exposure scenarios.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Independent sample concentrations only, no summary statistics.
	Metric 9:	Quality Assurance	High	Key QA/QC measures reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Did not characterize variability. Discussed uncertainties and limitations. No standard deviation or other measure of variance is provided.
Overall Quality Determination			Medium	

Study Citation:		Netherlands Institute for Fisheries Research, (2002.0). HBCD and TBBP-A in sewage sludge, sediments and biota, including interlaboratory study.		
HERO ID:		4269983		
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	N/A	Did not test for biomarkers
Domain 2: Representativeness	Metric 4:	Geographic Area	High	Netherlands
	Metric 5:	Currency	Low	Samples from 2000-2002
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size was not reported
	Metric 7:	Exposure Scenario	Medium	Data likely represents a relevant exposure scenario but the report lacks details about the population of interest
Domain 3: Accessibility/Clarity	Metric 8:	Reporting of Results	Low	Only individual sample concentrations
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not discussed
Domain 4: Variability and Uncertainty	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not characterized

Overall Quality Determination**Uninformative**

Study Citation:		Larsson, K., de Wit, C. A., Sellström, U., Sahlström, L., Lindh, C. H., Berglund, M. (2018.0). Brominated flame retardants and organophosphate esters in preschool dust and children’s hand wipes. Environmental Science & Technology 52(8):4878-4888.		
HERO ID:		4292136		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods and approaches described.
	Metric 2:	Analytical Methodology	High	Analytical methods provided, including recoveries and LOD.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed dust and hand wipes for the parent chemical TBBPA.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Sweden.
	Metric 5:	Currency	High	Samples were collected in 2015.
	Metric 6:	Spatial and Temporal Variability	Medium	One sample per kid, but 100 kids and samples in total.
	Metric 7:	Exposure Scenario	High	The data closely represent preschool environment exposure scenarios in Sweden.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data was not available, only summary statistics (ranges, medians)
	Metric 9:	Quality Assurance	High	Analytical QA/QC reported and summarized.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability was characterized (ranges only). Uncertainties were briefly discussed.
Overall Quality Determination			High	

Study Citation:		Garcia Lopez, M., Driffield, M., Fernandes, A. R., Smith, F., Tarbin, J., Lloyd, A. S., Christy, J., Holland, M., Steel, Z., Tlustos, C. (2018.0). Occurrence of polybrominated diphenylethers, hexabromocyclododecanes, bromophenols and tetrabromobisphenols A and S in Irish foods. Chemosphere 197:709-715.		
HERO ID:		5016905		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methods not reported such as sampler calibration and sample storage conditions
	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	Ireland
	Metric 5:	Currency	High	Samples collected in 2015
	Metric 6:	Spatial and Temporal Variability	Medium	>10 composite samples per food. Each composite sample was formed from a number of individual samples that were collected from across the country. Temporal variability not indicated (presumed over the course of the year).
	Metric 7:	Exposure Scenario	Medium	Exposure source not well characterized
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Results from composite samples were included as ranges and means; raw data from composite samples 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:		Inthavong, C., Hommet, F., Bordet, F., Rigourd, V., Guérin, T., Dragacci, S. (2017.0). Simultaneous liquid chromatography-tandem mass spectrometry analysis of brominated flame retardants (tetrabromobisphenol A and hexabromocyclododecane diastereoisomers) in French breast milk. Chemosphere 186:762-769.		
HERO ID:		5016975		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling protocol, including the informed consent of each mother, was approved by the local ethical committee in full compliance with the procedures of CNIL, France's National Commission for Information Technology and Civil Liberties.
	Metric 2:	Analytical Methodology	High	
	Metric 3:	Biomarker Selection	N/A	Extraction and analytical methods, instrument, calibration, recovery samples, LOQ reported.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Parent chemical in breast milk.
	Metric 5:	Currency	Medium	
	Metric 6:	Spatial and Temporal Variability	Medium	France
	Metric 7:	Exposure Scenario	High	Sampling in 2010.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	106 samples. No replicates.
	Metric 9:	Quality Assurance	High	Measuring chemical in breast milk.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Only summary statistics reported (mean, min, max, range). No individual data reported.
				Detailed QA/QC techniques, including method and laboratory performance. High recoveries (over >70%).
Overall Quality Determination		High		

Study Citation:	Lu, J. F., He, M. J., Yang, Z. H., Wei, S. Q. (2018.0). Occurrence of tetrabromobisphenol a (TBBPA) and hexabromocyclododecane (HBCD) in soil and road dust in Chongqing, western China, with emphasis on diastereoisomer profiles, particle size distribution, and human exposure. Environmental Pollution 242(Pt A):219-228.			
HERO ID:	5041213			
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling Methodology	Medium	Some 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	Western China
	Metric 5:	Currency	High	Samples collected in July 2016
	Metric 6:	Spatial and Temporal Variability	Medium	>10 samples total; multiple samples were collected at multiple sites; 3 sub-samples were collected at each site. Temporal variability was not evaluated.
	Metric 7:	Exposure Scenario	Medium	Exposure source not well characterized
Domain 3: Accessibility/Clarity	Metric 8:	Reporting of Results	Medium	Raw data not reported; only means and ranges were included
	Metric 9:	Quality Assurance	High	Key QA reported
Domain 4: Variability and Uncertainty	Metric 10:	Variability and Uncertainty	Medium	Some limitations reported
Overall Quality Determination			High	

Study Citation:		Kweon, D., Kim, M. K., Zoh, K. (2018.0). 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:		Li, H., Harvey, E., Sheng, G., Liu, H., Fu, J., La Guardia, M. J., Peng, P., Hale, R. C., Mainor, T. M. (2019.0). Brominated and organophosphate flame retardants along a sediment transect encompassing the Guiyu, China e-waste recycling zone. Science of the Total Environment 646:58-67.		
HERO ID:		5166925		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The authors reported information on the sampling equipment, procedures, sample storage and study site characteristics.
	Metric 2:	Analytical Methodology	Medium	The authors referenced two other studies and only summarized their extraction methods. Authors reported their analytical instrumentation, recovery results, and LOQ (Sec 2.3)
	Metric 3:	Biomarker Selection	N/A	The analyte was measured in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The geographic area is described in the methods section.
	Metric 5:	Currency	Medium	Samples were collected in 2013.
	Metric 6:	Spatial and Temporal Variability	Medium	Authors collected 29 samples along the mainsteam and tributary rivers. However, the samples were collected over three days, n January 25 and 28 so there was little variation in time.
	Metric 7:	Exposure Scenario	Medium	The authors characterized the types of point source pollution along the river.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data in SI. The authors only reported ranges in the main article, no standard deviation, frequency of detection or summary statistics.
	Metric 9:	Quality Assurance	Medium	The authors did not report collecting field blanks, but did analyze laboratory blanks and duplicates. They also reported the results of recovery tests.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	No standard deviation is reported in the main article. It may be reported in the supplemental information. Limited discussion on study limitations
Overall Quality Determination			Medium	

Study Citation:		Tay, J. H., Sellström, U., Papadopoulou, E., Padilla-Sánchez, J. A., Haug, L. S., de Wit, C. A. (2018.0). Assessment of dermal exposure to halogenated flame retardants: Comparison using direct measurements from hand wipes with an indirect estimation from settled dust concentrations. Environment International 115:285-294.		
HERO ID:		5349328		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	They cited previously published work for more information about sampling methodology. However, they outlined the sampling procedure using hand wipes, sampling equipment, sample storage conditions (at -20C) but not storage duration, and how a blank was obtained.
	Metric 2:	Analytical Methodology	High	Analytical methods were well-described, and they reported LOD, LOQ, and recoveries in the SI.
	Metric 3:	Biomarker Selection	N/A	They did not test for biomarkers, but rather for parent chemicals on people’s skin.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Norway
	Metric 5:	Currency	Medium	Sampling occurred in 2013 and 2014.
	Metric 6:	Spatial and Temporal Variability	Low	There were 60 samples, predominantly collected in the evening from women who worked at the Norwegian Institute of Public Health; there were no replicates. This sampling approach does not capture the variability of contamination that might be present on the hands of people from a wider swath of occupations, in a greater range of settings, and from a more even mix of men and women.
	Metric 7:	Exposure Scenario	High	Data closely represent relevant dermal exposure scenarios to TBBPA in people who resemble the study participants. A questionnaire was used to collect information on the potential sources of exposure. Dust levels were also measured to provide some additional information about microenvironments. There were no exposure controls.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data were provided; the summary statistics provided were detection frequency, median, mean, and range.
	Metric 9:	Quality Assurance	High	They identified detailed QA/QC techniques, including assessment of recoveries, and analyzed control samples. They corrected for levels measured in blanks. Recoveries were on the high side, from 112-127% for TBBPA.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	This paper characterized uncertainties and limitations extensively. Characterizations of variability were limited. Some information about variability can be gleaned from the data and comparisons to the results from one or two other studies, but the SD from this dataset was not reported.
Overall Quality Determination			High	

Study Citation:		Giovanoulis, G., Nguyen, M. A., Arwidsson, M., Langer, S., Vestergren, R., Lagerqvist, A. (2019.0). 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:		Rivière, G., Jean, J., Gorecki, S., Hulin, M., Kolf-Clauw, M., Feidt, C., Picard-Hagen, N., Vasseur, P., Le Bizec, B., Sirot, V. (2019.0). Dietary exposure to perfluoroalkyl acids, brominated flame retardants and health risk assessment in the French infant total diet study. Food and Chemical Toxicology 131:110561.		
HERO ID:		5412462		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sample collected according to previous reference. Sampling procedure included preparation according to most common method within French households and detailed in paper. No information on specific sampling equipment or storage.
	Metric 2:	Analytical Methodology	Medium	Includes information on extraction method and instrumentation. LOQ and recoveries are reported as a range.
	Metric 3:	Biomarker Selection	N/A	Testing for parent compound in food media.
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	Medium	For each food item composites included 1-45 subsamples.
	Metric 7:	Exposure Scenario	High	Closely followed common food preparation methods.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Provide lower and upper mean concentrations and min/max but no other summary statistics.
	Metric 9:	Quality Assurance	Low	Recoveries ranged from 30-80%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Uncertainty/variance accounted for by reporting upper and lower means estimates but no standard deviation or other measure of variance.
Overall Quality Determination			Medium	

Study Citation:		Zhang, H., Kelly, B. C. (2018.0). Sorption and bioaccumulation behavior of multi-class hydrophobic organic contaminants in a tropical marine food web. Chemosphere 199:44-53.		
HERO ID:		5427902		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Seawater, sediment, fish, and SPOM collected; fish species listed in Supplemental Information Table 2.
	Metric 2:	Analytical Methodology	High	Details provided in Supporting Information; GC-MS/MS; GC-EI-MS/MS and LC-ESI-MS/MS.
	Metric 3:	Biomarker Selection	High	Parent chemical in fish tissues.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Singapore Strait (marine) Southeast Asia.
	Metric 5:	Currency	Medium	2011 and 2012
	Metric 6:	Spatial and Temporal Variability	High	More than 10 samples of seawater, sediment, plankton tows, and fish (up to 24).
	Metric 7:	Exposure Scenario	High	Concentrations in fish, water, and sediment allowed calculation of in-field bioaccumulation factors (BAFs).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	DF, geometric mean, n, and 95% CI reported by fish species and by medium in Supplemental Tables. Not detected in seawater or in fish; detected in plankton and sediments.
	Metric 9:	Quality Assurance	Medium	Briefly described in Supplemental Information only.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Reasonable number of different fish species and individual fish per species sampled. Data on % lipid provided. Survey of 90 different chemicals in general location; provides comparisons with other studies at other times and locations.
Overall Quality Determination			High	

Study Citation:		Wang, L., Li, Y., Zhang, P., Zhang, S., Li, P., Wang, P., Wang, C. (2019.0). Sorption removal of phthalate esters and bisphenols to biofilms from urban river: From macroscopic to microcosmic investigation. Water Research 150:261-270.		
HERO ID:		5432773		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Limited information on sample storage conditions and durations.
	Metric 2:	Analytical Methodology	Low	LOQ, LOD, detection limits, and/or reporting limits not reported.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	High	Sampling began in 2017
	Metric 6:	Spatial and Temporal Variability	Medium	8-12 samples from Table 2. Sample size not explicitly stated or easy to find. Table S3 calculates the average concentration of two different sites using three samples each.
	Metric 7:	Exposure Scenario	Medium	May represent a relevant scenario, limited information on population of interest.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations not provided, only summary statistics.
	Metric 9:	Quality Assurance	Low	Quality assurance/controls were not directly discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Limited discussion on variability, uncertainties and study limitations.
Overall Quality Determination			Medium	

Study Citation:		Zhu, Q., Jia, J., Wang, Y., Zhang, K., Zhang, H., Liao, C., Jiang, G. (2019.0). Spatial distribution of parabens, triclocarban, triclosan, bisphenols, and tetrabromobisphenol A and its alternatives in municipal sewage sludges in China. Science of the Total Environment 679:61-69.		
HERO ID:		5489145		
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	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China (country-wide)
	Metric 5:	Currency	High	Samples collected in 2017 and 2018
	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			High	

Study Citation:		Yang, Y., Lu, L., Zhang, J., Yang, Y., Wu, Y., Shao, B. (2014.0). Simultaneous determination of seven bisphenols in environmental water and solid samples by liquid chromatography-electrospray tandem mass spectrometry. Journal of Chromatography A 1328:26-34.		
HERO ID:		5490836		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Water samples (river and sewage influent and effluent) transported in coolers, filtered, stored at -18 °C. Surface sediment (0-5 cm) collected via grab sampler. Sludge collected from secondary sedimentation tank of STP. Solid samples freeze dried and ground, stored at 4 °C. Not all sampling procedures and equipment described. Sample storage duration not reported.
	Metric 2:	Analytical Methodology	High	Water samples extracted using hydrophilic lipophilic balanced (HLB) solid-phase extraction (SPE) and MAX SPE cartridges. Solid samples were treated with ultrasonic extraction and centrifuged, followed by HLB and MAX SPE. LC-MS/MS; recoveries; MLOQ/MLOD provided in Table 3.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Hangzhou Bay in Zhejiang, China
	Metric 5:	Currency	Medium	2012
	Metric 6:	Spatial and Temporal Variability	Medium	5 samples of river water and 5 samples of river sediment.
	Metric 7:	Exposure Scenario	Medium	Concentration in river water and sediment in China is described, but exposure source is not described.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Table 4 provides raw data and concentration by river water and sediment site.
	Metric 9:	Quality Assurance	High	Recoveries for method provided in Table 3; blanks
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No discussion of variability and uncertainty.
Overall Quality Determination			Medium	

Study Citation:		Yang, Y., Guan, J., Yin, J., Shao, B., Li, H. (2014.0). Urinary levels of bisphenol analogues in residents living near a manufacturing plant in south China. Chemosphere 112:481-486.		
HERO ID:		5490843		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Key sampling methods were reported, such as sampling equipment and sample storage. The study says the samples came from residents that live "near" a BPA F manufacturing facility, but did not clarify the distance within which residents lived, which could be materially different for different persons included.
	Metric 2:	Analytical Methodology	High	Key analytical methods were reported, including the extraction methods, instrumentation, calibration, and LOD.
	Metric 3:	Biomarker Selection	High	A variety of bisphenols were analyzed in urine. TBBPA was measured, but not detected; it is an acceptable biomarker, leading to my high rating. Whether any BPA detected derived from exposures to BPA, TBBPA, or another compound is unknown; this issue was not discussed.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	Medium	Samples were collected in 2013.
	Metric 6:	Spatial and Temporal Variability	Low	There were 94 samples, but no replicates. Rated low because they were unpooled spot samples.
	Metric 7:	Exposure Scenario	Medium	Data reflect a relevant exposure scenario. One possible exposure source was characterized, but additional possible sources were not. The researchers did not gather any data about household items that might contain bisphenols.
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 75th percentile, along with range.
	Metric 9:	Quality Assurance	High	Key QA methods were reported, including assessment of recoveries and testing of urine collection tubes and of blanks. There were no control samples of individuals who did not live near the factory.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability was discussed, such as possible age and gender differences, as were a few sources of uncertainty. Few gaps and limitations were identified.
Overall Quality Determination			Medium	

Study Citation:		Malysheva, S. V., Goscinnny, S., Malarvannan, G., Poma, G., Andjelkovic, M., Voorspoels, S., Covaci, A., Van Loco, J. (2018.0). Development and validation of a quantitative UHPLC-MS/MS method for selected brominated flame retardants in food. Food Additives & Contaminants: Part A, Chemistry, Analysis, Control, Exposure & Risk Assessment 35(2):292-304.		
HERO ID:		5496737		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology is discussed in the data source is generally appropriate (i.e., scientifically sound) for the chemical and media of interest, however, sample storage duration not specified.
	Metric 2:	Analytical Methodology	High	Analytical methodology is discussed in detail and is clear and appropriate (i.e., scientifically sound) for the chemical and media of interest.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Belgium.
	Metric 5:	Currency	Low	No sampling date is provided, but publication date is 2018.
	Metric 6:	Spatial and Temporal Variability	Medium	Study captured a variety of different food types (24 individual food samples comprising fish, meat, chicken eggs, cow milk, baby food, oils, cheese, and vegetables), but there were no replicates of individual food samples.
	Metric 7:	Exposure Scenario	Medium	The data likely represent the relevant exposure scenario. The exposure source is not well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Concentrations for TBBPA in all samples were reported as below LOQ.
	Metric 9:	Quality Assurance	High	Key QA/QC measures reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations were reported. Study reported uncertainty measurement of the method, but there were no replicates of individual food samples.
Overall Quality Determination			Medium	

Study Citation:		Si, W., Cai, Y., Liu, J., Shen, J., Chen, Q., Chen, C., Ning, L. (2019.0). Investigating the role of colloids on the distribution of bisphenol analogues in surface water from an ecological demonstration area, China. Science of the Total Environment 673:699-707.		
HERO ID:		5496828		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	2L water samples were collected in triplicate, stored with dry ice, filtered and divided into dissolved colloidal and truly dissolved fractions (both of which were analyzed). They were collected according to technical specs of State Environmental Protection Administration of China, which would be widely accepted and scientifically sound. The sampling equipment, exact sampling procedures, and whether samples were collected or stored in plastic vessels were not specified in this paper.
	Metric 2:	Analytical Methodology	High	Analytical methods included solid-phase extraction and analysis via LC-MS/MS. Calibration curves were used, and recoveries were determined to be 72-113%. Table S4 provides the LOD and LOQ.
	Metric 3:	Biomarker Selection	N/A	Parent chemicals were analyzed in the environment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Wujin National Ecological Demonstration Area of Jiangsu Province, northwestern coast of Taihu Lake, China
	Metric 5:	Currency	High	Samples were collected in August 2018.
	Metric 6:	Spatial and Temporal Variability	High	Samples were collected in triplicate in the same month. There were 38 samples, some from urban rivers, other from rivers in agricultural areas, and others from two different lakes.
	Metric 7:	Exposure Scenario	Medium	Concentrations were reported of truly dissolved phase and colloidal phase of surface waters from an economically developed region, near the third largest freshwater lake in China. No information on sources of chemicals is known. However, the data closely represent a relevant/realistic exposure scenario. One of the lakes sampled is a source of drinking water, but there were no tap samples of water distributed from the lake.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data available in the paper or SI. Table 1 contains means, medians, ranges, and detection frequency (I dissolved and colloidal phase). No confidence intervals, SDs, etc. Figures 2 and 4 show results for each sampling site as bar graphs with BPA and several different types of bisphenol analogs, including TBBPA, but it is nearly impossible to discern concentrations of TBBPA at each site since BPA dominates these figures.
	Metric 9:	Quality Assurance	High	The study discusses QA in a dedicated subsection and in the SI. They used a standard, blanks, and calibration curves, and they calculated recoveries (in the acceptable range, 72-113%).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability is discussed across sampling sites, and results are compared to other studies. The only uncertainties discussed have to do not with the monitoring data, but with the risk assessments included that were based on estimated daily water intake. Limitations were not discussed. Data gaps in available scientific knowledge were mentioned.
Overall Quality Determination			High	

Study Citation:		Martínez, M. Á., Castro, I., Rovira, J., Ares, S., Rodríguez, J. M., Cunha, S. C., Casal, S., Fernandes, J. O., Schuhmacher, M., Nadal, M. (2019.0). Early-life intake of major trace elements, bisphenol A, tetrabromobisphenol A and fatty acids: Comparing human milk and commercial infant formulas. Environmental Research 169:246-255.		
HERO ID:		5497323		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology was fairly detailed, including mention of avoidance of the use of plastic vials, but a few details were missing, like amount of human milk collected from each mother and any specifics on sample collection procedures and the amount of formula prepared before it was homogenized in a 1 g sample. Sample storage duration was not mentioned, but the samples of human milk were stored on ice, then at -20 C once the researchers received them.
	Metric 2:	Analytical Methodology	High	Detailed analytical methods were included, and the study reported LOD, LOQ, and results of recovery experiments.
	Metric 3:	Biomarker Selection	High	Biomarker is the chemical of interest in human milk and formula.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Spain.
	Metric 5:	Currency	Low	Sample collection date was not specified, but the study was published in 2019.
	Metric 6:	Spatial and Temporal Variability	Low	There were 53 human milk samples and 50 formula samples. There were no replicates mentioned.
	Metric 7:	Exposure Scenario	Medium	Data closely represents relevant exposure scenarios. However, specific exposure sources to mothers and to formula were not assessed.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics were included, likely the mean and the SD in different groups (by brand of formula or number of months the mother had been breastfeeding).
	Metric 9:	Quality Assurance	High	Detailed QA/QC techniques were described, including recoveries, blanks, and sampling/accounting for chemicals in the bottled water to which the formula was added.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The study characterized variability across different subsets of samples, but did not discuss uncertainties and limitations.
Overall Quality Determination			Medium	

Study Citation:		Ganci, A. P., Vane, C. H., Abdallah, M. A. E., Moehring, T., Harrad, S. (2019.0). Legacy PBDEs and NBFRs in sediments of the tidal River Thames using liquid chromatography coupled to a high resolution accurate mass Orbitrap mass spectrometer. Science of the Total Environment 658:1355-1366.		
HERO ID:		5497484		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology is discussed and is generally appropriate (i.e., scientifically sound) for the chemical and media of interest, however, the sampling procedure is only briefly discussed.
	Metric 2:	Analytical Methodology	High	Analytical methodology is discussed in detail and is clear and appropriate (i.e., scientifically sound) for the chemical and media of interest.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in the UK.
	Metric 5:	Currency	Medium	Samples collected in 2011.
	Metric 6:	Spatial and Temporal Variability	Medium	Forty-five surface sediment samples collected. Collection of replicate samples not reported.
	Metric 7:	Exposure Scenario	Medium	The data likely represent relevant/realistic exposure scenario, but the use of expose controls was not described.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data reported in SI. Summary statistics reported, but are missing a measure of variation.
	Metric 9:	Quality Assurance	Medium	QA/QC techniques and results were discussed. Recoveries and blank samples were used, but baseline samples were not reported..
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Key uncertainties, limitations, and data gaps are not discussed. No measure of variance is provided.
Overall Quality Determination			Medium	

Study Citation:		Yin, J., Meng, Z., Zhu, Y., Song, M., Wang, H. (2011.0). Dummy molecularly imprinted polymer for selective screening of trace bisphenols in river water. Analytical Methods 3(1):173-180.		
HERO ID:		5497732		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Samples collected from 3 sites along a river; samples filtered, stored at 4 °C; analysis carried out 72 h after collection; sampling equipment and procedure not described.
	Metric 2:	Analytical Methodology	High	Molecularly imprinted solid phase extraction (MISPE); HPLC UV; recoveries; LOD was 5 ng/L or 250 pg in mass
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Qinghe river, China
	Metric 5:	Currency	Medium	2009
	Metric 6:	Spatial and Temporal Variability	Low	Samples collected from 3 river sites in June.
	Metric 7:	Exposure Scenario	Medium	Concentration in river in China; WWTP and industry park nearby. Limited information on population of interest.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data not reported. Table 2 provides concentration (mean and std deviation) of river samples collected at three sites; not clear sample size per site.
	Metric 9:	Quality Assurance	High	Method validation discussed in Section 3.5; method recoveries provided in Table 1.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Discusses variation of bisphenol proportions by site (fig. 5).
Overall Quality Determination			Medium	

Study Citation:		Lee, H. B., Peart, T. E. (2002.0). Organic contaminants in Canadian municipal sewage sludge. Part I. Toxic or endocrine-disrupting phenolic compounds. Water Quality Research Journal of Canada 37(4):681-696.		
HERO ID:		5497906		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methods were not reported such as sample storage conditions and what type of vessel samples were transported in.
	Metric 2:	Analytical Methodology	High	Key analytical methods were reported, such as extraction method, analytical instrumentation, evaluation of recoveries, and detection limits.
	Metric 3:	Biomarker Selection	N/A	Parent chemicals were tested in sewage sludge.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Canada
	Metric 5:	Currency	Low	Samples were collected from 1999 to 2001.
	Metric 6:	Spatial and Temporal Variability	Medium	There were 35 samples, but no replicates.
	Metric 7:	Exposure Scenario	Medium	Sewage sludge that can be applied to land can provide relevant information about exposure. Exposure sources were not well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were reported. No summary statistics other than range were reported.
	Metric 9:	Quality Assurance	Medium	Key QA methods were reported and included monitoring recovery rates of surrogates for some chemicals. Some samples were extracted twice "to ensure that the analysis was in control." There were no control samples or blanks mentioned.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	While the raw data reveal the variability, no uncertainties, gaps or limitations were reported.
Overall Quality Determination			Medium	

Study Citation:		Gustavsson, J., Wiberg, K., Ribeli, E., Nguyen, M. A., Josefsson, S., Ahrens, L. (2018.0). Screening of organic flame retardants in Swedish river water.		
HERO ID:		Science of the Total Environment 625:1046-1055. 5499542		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology and site characteristics are well described.
	Metric 2:	Analytical Methodology	High	Sampling methodology is well described. MDLs are reported in Supporting Information.
	Metric 3:	Biomarker Selection	N/A	Biomarker of exposure was measured in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Sweden.
	Metric 5:	Currency	Medium	Sampling was conducted in October 2013.
	Metric 6:	Spatial and Temporal Variability	Low	Spatial variability are well characterized, but all samples were collected at one time point with no replicates.
	Metric 7:	Exposure Scenario	High	Study site and potential sources are well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data and summary statistics are reported in supporting information.
	Metric 9:	Quality Assurance	High	Study applied quality control measures and no issues were identified.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	There is limited discussion about uncertainty and limitations. There is some variability measured in river locations and population density.
Overall Quality Determination			High	

Study Citation:		Watanabe, I., Kashimoto, T., Tatsukawa, R. (1983.0). The flame retardant tetrabromobisphenol-A and its metabolite found in river and marine sediments in Japan. Chemosphere 12(11):1533-1539.		
HERO ID:		5518390		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some methods not reported such as sample storage conditions and sampling depth.
	Metric 2:	Analytical Methodology	Low	LOD nor LOQ reported
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Japan
	Metric 5:	Currency	Low	Between 1981 and 1983.
	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	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:		SUNY, (2019.0). Halogenated flame retardants in mangrove sediments from the Pearl River Estuary, South China: Comparison with historical data and correlation with microbial community. Chemosphere 227:315-322.		
HERO ID:		5518932		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Most methods were reported, including sample storage conditions (-20C) but not duration, which is unlikely to affect results. (While sampler calibration was not reported, it would not have been applicable to sediment collection with a stainless steel scoop.)
	Metric 2:	Analytical Methodology	Low	Key analytical methods were reported in detail, but the MDLs were reported as a range (0.0002 to 0.0496 ng/g) for all halogenated flame retardants.
	Metric 3:	Biomarker Selection	N/A	They sampled for parent chemicals in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	High	Samples were collected in 2015 and 2012.
	Metric 6:	Spatial and Temporal Variability	Medium	There were no replicates. There were 13 to 21 samples per location in 2015. For the 2012 samples, the paper does not say how many samples were collected per location.
	Metric 7:	Exposure Scenario	Medium	The data represent a relevant exposure scenario. Possible reasons for increasing concentrations over time (sourced) were identified. There was also a reference in the text to "burgeoning electronic/electrical manufacturing industries" in the region. There were no exposure controls or specific sources near some of the wetland systems identified, leading to the medium rating.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported. Summary statistics reported included the range, median, and mean in each region, for the 2015 samples. SD was not reported. The 2012 samples are shown only in a figure, which probably contains the mean detection per region.
	Metric 9:	Quality Assurance	Medium	Blanks were used as part of QA. Recoveries were not reported for this chemical. There were no baseline samples.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No sources of uncertainty, gaps or limitations were reported, but there was some discussion of possible explanations for variability, and data were compared across three cities and two time periods, providing some information about variability over time and space.
Overall Quality Determination			Medium	

Study Citation:		Gong, W.j, Zhu, L.,y, Jiang, T,t, Han, C. (2017.0). The occurrence and spatial-temporal distribution of tetrabromobisphenol A in the coastal intertidal zone of Qingdao in China, with a focus on toxicity assessment by biological monitoring. Chemosphere 185:462-467.		
HERO ID:		5519030		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some 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	Qingdoa, China
	Metric 5:	Currency	Medium	Samples collected in 2012 and 2013
	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 reported; summarized throughout text
	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:		Abdallah, M. A. E., Bressi, M., Oluseyi, T., Harrad, S. (2016.0). Hexabromocyclododecane and tetrabromobisphenol-A in indoor dust from France, Kazakhstan and Nigeria: Implications for human exposure. Emerging Contaminants 2(2):73-79.		
HERO ID:		5519202		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods were reported for the dust samples.
	Metric 2:	Analytical Methodology	High	Key analytical methods were reported, including extraction method, analytical instrumentation, calibration, recoveries, and LOQs.
	Metric 3:	Biomarker Selection	N/A	Samples were from dust of parent chemic
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	France, Kazakhstan and Nigeria
	Metric 5:	Currency	Medium	Samples collected between 2008 and 2014
	Metric 6:	Spatial and Temporal Variability	Medium	There were 27-31 samples per country, 7-11 per microenvironment (car, home, or office). There were no repli
	Metric 7:	Exposure Scenario	Medium	The data represent realistic exposure scenarios. However, the exposure sources were not well characterized, and there were no exposure controls.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	The raw data were included in the SI. Some summary statistics (5th and 95th percentile, average, and median) were included, but no SD.
	Metric 9:	Quality Assurance	High	Key QA reported included recoveries, results from blanks, and replicates to test the method for HBCD/results from a matrix spike to test the method for TBBPA.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The only uncertainties mentioned pertained to the estimates of intake for adults and children. There was some discussion of variability across the 3 countries sampled and compared to studies of other countries. Few gaps and limitations were reported.
Overall Quality Determination			High	

Study Citation:		Watanabe, I., Kashimoto, T., Tatsukawa, R. (1983.0). Identification of the flame retardant tetrabromobisphenol-A in the river sediment and mussel collected in Osaka. Bulletin of Environmental Contamination and Toxicology 31(1):48-52.		
HERO ID:		5519413		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	A lot of pertinent sampling methods were not reported, such as equipment, sample regimen, and storage.
	Metric 2:	Analytical Methodology	Low	LOD and LOQ were not reported.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in sediment and mussels.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Japan.
	Metric 5:	Currency	Low	Sediment sample was collected in September 1981 and mussels in October 1981.
	Metric 6:	Spatial and Temporal Variability	Low	One sediment sample was collected. It is unclear how many mussel samples were collected. No replicates were reported.
	Metric 7:	Exposure Scenario	Medium	Exposure source and setting were not sufficiently described.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data were not reported. Most data represented by chromatograms and lacking summary statistics.
	Metric 9:	Quality Assurance	Low	QA/QC was not reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Characterization of variance and a discussion of limitations/uncertainties were missing.
Overall Quality Determination			Low	

Study Citation:		Ve Nisseau, A., Brosseau, A., Bizec, B. L., Bichon, E., Lesquin, E., Larvor, F., Dervilly-Pinel, G., Marchand, P., Durand, S., Vaccher, V. (2018.0). Occurrence of legacy and novel brominated flame retardants in food and feed in France for the period 2014 to 2016. Chemosphere 207:497-506.		
HERO ID:		5519480		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some methods not reported such as sample storage conditions
	Metric 2:	Analytical Methodology	High	While the sample extraction, purification, and extraction procedures were described in detail, LOQs were not provided even though authors explained how they were calculated.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in food.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Food samples were randomly collected from supermarkets, markets, and farms in France.
	Metric 5:	Currency	High	Samples collected in 2014 to 2016
	Metric 6:	Spatial and Temporal Variability	Medium	A total of 607 samples were collected without any reporting of replicates.
	Metric 7:	Exposure Scenario	High	The general population’s exposure to TBBPA via food that was contaminated by TBBPA’s widespread and long-time use is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics included median, range, and detection frequency. Raw data were not reported, but note that there were about 600 samples.
	Metric 9:	Quality Assurance	Medium	QC/QA was reported but not recovery even though authors they described methods to determine recovery.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some uncertainties, gaps, and limitations were reported in the QA/QC section (e.g., reproducibility uncertainty).
Overall Quality Determination			High	

Study Citation:		Sellstrom, U., Jansson, B. (1995.0). Analysis of tetrabromobisphenol A in a product and environmental samples. Chemosphere 31(4):3085-3092.		
HERO ID:		5519644		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	0.5g filings were sampled from circuit board bought in a local store; surficial sediments (1cm) were taken with a core sampler from upstream and downstream of a plastics factory using TBBPA; and sewage sludge samples were analyzed (one sample from STP that receives leachate from a landfill that receives waste from the factory and the other from STP with no known users of TBBPA). Sampling methodology was only briefly discussed, and sample storage was not discussed. Details on the sampling equipment were sparse.
	Metric 2:	Analytical Methodology	Low	Sample extractions are discussed on p.3087-3088. The study’s authors used GC/MS. They did not determine recoveries for the circuit board sample but did report recoveries for sediment and sewage. The limit of detection was not provided.
	Metric 3:	Biomarker Selection	N/A	The chemical of interest was measured in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Sweden.
	Metric 5:	Currency	Low	Sampling date was not provided; the study was published in 1995.
	Metric 6:	Spatial and Temporal Variability	Low	Filings were from 1 circuit board; there were 2 sediment and 2 sewage sludge samples. There were no replicates. The sampling approach poorly captures the variability of environmental contamination.
	Metric 7:	Exposure Scenario	High	The study’s authors measured the concentration in printed circuit board filings as well as sediments and sewage sludge near a plastics plant using TBBPA. They also measured TBBPA in sludge from a sewage plant receiving no known sources of TBBPA, as something of a control, similar to having an upstream sediment sample and downstream sample.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1 provides the concentrations in all sediment and sludge samples by ignition loss and dry weight. There were no summary statistics. It is not clear from the data table or the discussion which sewage sludge sample is which, in terms of one being from a plant that receives leachate from the plastics plant. A discussion of results for circuit board was provided in first paragraph of results (p. 3089).
	Metric 9:	Quality Assurance	Medium	QA was not discussed in detail. The authors did endeavor to have pre-exposure samples. A blank was also sampled. They did not measure recoveries for the circuit board; recoveries were between 79% and 86% for sediment and sludge but were not corrected for losses.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Concentrations of TBBPA were 10 times higher downstream of factory than upstream. The differences in the results between the two sewage sludge samples were not discussed at all. The authors reported that filings results were probably underestimated due to incomplete extraction (because the extraction method used for the product sample probably only extracted the fraction of the acidic compounds present on the surface of the filings). Uncertainties were not all well-explained. For example, the authors noted that a brominated compound with the same retention time as the derivatised TBBPA was seen in both of the sewage sludge samples but the concentrations were too low to confirm this with another ionization technique; however, the potential significance of this was not explained.
Overall Quality Determination			Low	

Study Citation:		Poma, G., Covaci, A., Govindan, M., Joris Van, L., Goscinnny, S., Voorspoels, S., Malysheva, S. V. (2018.0). Occurrence of selected halogenated flame retardants in Belgian foodstuff. Chemosphere 194:256-265.		
HERO ID:		5519714		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling method, food types, and preparation reported. Details on the foods reported in supplemental file.
	Metric 2:	Analytical Methodology	Medium	Extraction and analytical methods, instrument, and LOQ reported. Some information missing such as calibration, but additional reference is cited (Poma et al. (2016)).
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Belgium
	Metric 5:	Currency	High	Samples collected 2015 - 2016
	Metric 6:	Spatial and Temporal Variability	Medium	1289 total samples. Some food types >10 samples, some <5. No replicates.
	Metric 7:	Exposure Scenario	High	Measuring TBBPA in various food sources.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data reported in supplemental file. Summary statistics for each food group reported (table 1).
	Metric 9:	Quality Assurance	Medium	QA measures applied and procedural blanks were analyzed. The mean recoveries of the spiked IS ranged from 68 to 123%, value not reported specifically for TBBPA.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variability is characterized in the different types of food sampled. The mean expanded uncertainty of the methods ranged between 3 and 37%.
Overall Quality Determination			High	

Study Citation:		Choo, G., Lee, I. S., Oh, J. E. (2019.0). Species and habitat-dependent accumulation and biomagnification of brominated flame retardants and PBDE metabolites. Journal of Hazardous Materials 371:175-182.		
HERO ID:		5546563		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Study site characteristics (southern part of South Korea at various depths of seawater) reported. Minimal or no information reported on sampling equipment, sampling procedure, sample storage conditions/duration.
	Metric 2:	Analytical Methodology	Medium	Extraction method, instrumentation, instrument calibration all reported. Limits of detection and recoveries reported as ranges.
	Metric 3:	Biomarker Selection	N/A	Study testing for parent compound in aquatic species.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	South Korea
	Metric 5:	Currency	High	Samples collected in 2016
	Metric 6:	Spatial and Temporal Variability	High	A total of 20 species were analyzed with 10-50 samples collected each and composited. Samples were collected from the same species in different habits for comparison.
	Metric 7:	Exposure Scenario	Medium	Exposure reported as due to persistence in the environment with no specific exposure scenario or microenvironment.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Concentration reported for each pooled sample type, but no summary statistics reported.
	Metric 9:	Quality Assurance	Low	Recoveries for TBBPA were 47-83% but no corrections were made for low recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No standard deviation or measure of variance.
Overall Quality Determination			Medium	

Study Citation:		Chokwe, T. B., Okonkwo, J. O., Nwamadi, M. S. (2017.0). Occurrence and distribution of tetrabromobisphenol A and its derivative in river sediments from Vaal River Catchment, South Africa. Emerging Contaminants 3(3):121-126.		
HERO ID:		5546596		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling equipment, depth, and locations were described. Some methods not reported such as sampler calibration and sample storage.
	Metric 2:	Analytical Methodology	Medium	Extraction method was explained. Instrumentation and analytical method were also presented. Samples were spiked to determine recoveries. The limits of detection were presented as a range for TBBPA and its derivatives, so the exact LOD is unknown.
	Metric 3:	Biomarker Selection	N/A	Environmental samples were analyzed for the chemical.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	South Africa
	Metric 5:	Currency	High	Samples were collected in September-November 2016.
	Metric 6:	Spatial and Temporal Variability	Medium	There were 13 sampling sites. While no samples were specifically collected to serve as replicates, at each site, a sample was collected from each bank of the river and the center of the river.
	Metric 7:	Exposure Scenario	Medium	Data represent exposure to anyone who comes into contact with these rivers. Potential exposure sources were identified for some of the sites where there were detections of high levels of the TBBPA analog TBBPA-BAE. However, more description could have been included about potential exposure sources at sites where TBBPA was highest. There were no exposure control samples.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data were reported in the SI (Table S1 has 3 samples for each site). Table 1 has the mean for each site, as well as the overall mean, median, range, and DF for the chemical.
	Metric 9:	Quality Assurance	Low	Key aspects of QA were reported, including use of blanks determination of recoveries. However, the average percent recovery (reported "after background concentration correction") was 64.4%. Samples were not corrected for percent recovery, so I rated this as low.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	There was more discussion of variability in levels of TBBPA derivatives detected as part of this study than of TBBPA itself. Results from this study were compared to data on TBBPA concentrations in sediment from other studies. There was no discussion of uncertainty, gaps in this study, or its limitations.
Overall Quality Determination			Medium	

Study Citation:		Fujii, Y., Kato, Y., Masuda, N., Harada, K. H., Koizumi, A., Haraguchi, K. (2018.0). Contamination trends and factors affecting the transfer of hexabromocyclododecane diastereomers, tetrabromobisphenol A, and 2,4,6-tribromophenol to breast milk in Japan. Environmental Pollution 237:936-943.		
HERO ID:		5549543		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Most sampling methods, including study participant characteristics and sample storage condition, were reported. However, there was limited information on sampling equipment and other protocols to ensure consistency.
	Metric 2:	Analytical Methodology	High	Key analytical methods reported, including citation to previously established methods.
	Metric 3:	Biomarker Selection	N/A	TBBPA itself was tested and not a biomarker.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Japan.
	Metric 5:	Currency	Medium	Samples were collected between 2008 and 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	64 samples were collected without replicates.
	Metric 7:	Exposure Scenario	High	This is a biomonitoring study where exposure is expected though the widespread use of TBBPA as a flame retardant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	High	Key QA was reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Gaps and limitations were not reported.
Overall Quality Determination			Medium	

Study Citation:		Barghi, M., Shin, E. S., Choi, S. D., Dahmardeh Behrooz, R., Chang, Y. S. (2018.0). HBCD and TBBPA in human scalp hair: Evidence of internal exposure. Chemosphere 207:70-77.		
HERO ID:		5550302		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods, equipment, and storage all reported, as well as subject information.
	Metric 2:	Analytical Methodology	High	Extraction instrument and method reported. LOD reported.
	Metric 3:	Biomarker Selection	High	The study analyzed TBBPA in hair samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Korea, and Iran.
	Metric 5:	Currency	High	Samples collected in 2017
	Metric 6:	Spatial and Temporal Variability	Medium	>10 samples but no replicates
	Metric 7:	Exposure Scenario	High	The study measured TBBPA in hair samples, although there is no information about the source of the chemical.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	no raw data
	Metric 9:	Quality Assurance	High	QA and QC methods described. Calibration and recoveries reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	No limitations reported. Variability accounted for in different populations sampled.
Overall Quality Determination			High	

Study Citation:		Yang, Y., Yu, J., Yin, J., Shao, B., Zhang, J. (2014.0). Molecularly imprinted solid-phase extraction for selective extraction of bisphenol analogues in beverages and canned food. Journal of Agricultural and Food Chemistry 62(46):11130-11137.		
HERO ID:		5551244		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	All pertinent sampling information is provided.
	Metric 2:	Analytical Methodology	High	All pertinent sampling information is provided.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Beijing, China
	Metric 5:	Currency	Medium	Samples collected in 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	No replicate samples collected. 19 samples collected (various beverages and canned foods).
	Metric 7:	Exposure Scenario	Medium	The data closely represent relevant/realistic exposure scenario but is not well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data reported, but TBBPA not detected in any samples.
	Metric 9:	Quality Assurance	High	The QA/QC results are provided including procedural blanks and recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study has limited discussion of key uncertainties, limitations, and data gaps.
Overall Quality Determination			High	

Study Citation:		Kicinski, M., Viaene, M. K., Den Hond, E., Schoeters, G., Covaci, A., Dirtu, A. C., Nelen, V., Bruckers, L., Croes, K., Sioen, I., Baeyens, W., Van Larebeke, N., Nawrot, T. S. (2012.0). Neurobehavioral function and low-level exposure to brominated flame retardants in adolescents: a cross-sectional study. Environmental Health 11(1):86.		
HERO ID:		5635880		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Most sampling methods not reported such as sample collection procedure, sampler calibration, and sample storage. How the sample of children was arrived at is well-documented.
	Metric 2:	Analytical Methodology	Medium	Analysis methods were described briefly. They used GC/MS. The LOQ was reported. Recovery samples and instrument calibration were not reported. Another paper with more details as referenced.
	Metric 3:	Biomarker Selection	High	The parent chemical in blood is an appropriate biomarker.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Belgium
	Metric 5:	Currency	Medium	Samples were collected between 2008 and 2011.
	Metric 6:	Spatial and Temporal Variability	Medium	There were 515 samples, but no replicates.
	Metric 7:	Exposure Scenario	Medium	While the data closely represent a relevant exposure scenario, the exposure sources were not well characterized, as seems to be common across monitoring studies.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported; the paper reported the median, 75th percentile, 95th percentile, and maximum.
	Metric 9:	Quality Assurance	Low	QA techniques were not directly discussed, but the study used a protocol described in a separate paper, which may have included standard QA techniques. Considering how carefully different factors were considered that could have affected the results, it is likely that QA was included in the sample analysis process.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some limitations were reported. Including the median and the 75th and 95th percentile levels provided some information about variability, and there was a brief discussion of variability and uncertainty.
Overall Quality Determination			Medium	

Study Citation:		Pratt, I., Anderson, W., Crowley, D., Daly, S., Evans, R., Fernandes, A., Fitzgerald, M., Geary, M., Keane, D., Morrison, J. J., Reilly, A., Tlustos, C. (2013.0). Brominated and fluorinated organic pollutants in the breast milk of first-time Irish mothers: is there a relationship to levels in food?: Part A. Chemistry, Analysis, Control, Exposure { \& } Risk Assessment Part A. Chemistry, Analysis, Control, Exposure { \& } Risk Assessment. Food Additives & Contaminants: Part A, Chemistry, Analysis, Control, Exposure & Risk Assessment 30(10):1788.		
HERO ID:		5636379		
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	Medium	Recovery samples not reported
	Metric 3:	Biomarker Selection	High	Acceptable biomarker
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Ireland
	Metric 5:	Currency	Low	Sample collection not 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	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:		Gebbink, W. A., Van Der Lee, M. K., Peters, R. J. B., Traag, W. A., Dam, G.,t, Hoogenboom, R., Van Leeuwen, S. P. J. (2019.0). Brominated flame retardants in animal derived foods in the Netherlands between 2009 and 2014. Chemosphere 234:171-178.		
HERO ID:		5637438		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methods were not reported such as sample storage conditions and sampler calibration. Meat samples were primarily fat, but it's not clear where the fat came from because they were "assuming a homogeneous distribution of these contaminants over the fat compartments within the animal."
	Metric 2:	Analytical Methodology	Medium	Key analytical methods were reported, including extraction method, instrumentation, and introduction of recovery standards. In meat, liver, milk and eggs, a single LOQ was reported. However, in fish, the LOQ was reported as a range because they depended on the sample intake. Rated medium because the LOQ in fish was not a single value or reported for individual samples.
	Metric 3:	Biomarker Selection	N/A	The chemical of interest was tested in animals and eggs.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Netherlands
	Metric 5:	Currency	Medium	Samples were collected between 2009 and 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	There were more than 100 samples from terrestrial animals analyzed for this chemical and more than 25 samples from aquatic animals with results reported for this chemical, plus there were no detections above the detection limit in "all bovine and pig livers, horse and goat meat, cod, brown crab claws and body, dab, flounder, mussel, plaice, shrimp, sole, tilapia, trout, turbot, and whiting" samples. (Of these, the seafood samples are summarized in table 2.) No replicates were reported.
	Metric 7:	Exposure Scenario	Medium	The sources of exposure were not well characterized, but the data closely represent a relevant exposure scenario. There was no microclimate information included, but they did differentiate between farmed and wild-caught fish.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported. It is possible to discern the number of samples (except for liver samples), the number of detections per species, and the range of detections. In most cases, there were zero or one detection per species; no means or other summary statistics were reported.
	Metric 9:	Quality Assurance	High	Key QA reported included use of blanks and standards, as well as calculation of recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability across species was characterized. Few sources of uncertainty, gaps, and limitations were reported (e.g., mixtures of contaminants to which animals were exposed, small sample size).
Overall Quality Determination			Medium	

Study Citation:		SUNY, (2019.0). Bioaccumulation and translocation of tetrabromobisphenol A and hexabromocyclododecanes in mangrove plants from a national nature reserve of Shenzhen City, South China. Environment International 129:239-246.		
HERO ID:		5679991		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methods not reported such as sampling equipment and collection regimen.
	Metric 2:	Analytical Methodology	High	Analytical methods were reported in detail in both main text and SI, including information on sample extraction, instrumentation, and detection limits.
	Metric 3:	Biomarker Selection	N/A	Study tested for parent chemical in sediment and plants.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in China.
	Metric 5:	Currency	High	Samples collected in 2015
	Metric 6:	Spatial and Temporal Variability	Medium	A total of 51 samples were collected from three different mangrove species without 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 reported.
	Metric 9:	Quality Assurance	High	QA/QC methods included procedure blanks, spiked blanks, spiked matrices, and recoveries. Recoveries for TBBPA were acceptable, and specific values for each matrix are in Table S1.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Gaps and limitations were not reported.
Overall Quality Determination			Medium	

Study Citation:		Gao, C. J., Xia, L. L., Wu, C. C., Wong, C. S., Guo, Y. (2019.0). The effects of prosperity indices and land use indicators of an urban conurbation on the occurrence of hexabromocyclododecanes and tetrabromobisphenol A in surface soil in South China. Environmental Pollution 252(Pt B):1810-1818.		
HERO ID:		5680040		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling followed an EPA procedure. Sampling equipment was not identified; other sampling methods were specified. Soil samples (0-5cm) came from 6 land-use types (residency, industry, landfill, agriculture, forestry, and drinking water source) (Fig. 1). 3 subsamples were composited into one sample from each sampling site.
	Metric 2:	Analytical Methodology	High	Extraction details are thorough. Quantification was via liquid chromatography and triple quadrupole mass spec. They determined and corrected for recoveries. The limits of detection were 0.002 ng for this chemical.
	Metric 3:	Biomarker Selection	N/A	Soil samples were analyzed for the chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Pearl River Delta (Guangzhou, Foshan, Dongguan, Zhongshan, Zhuhai, Shenzhen, Zhaoqing, Qingyuan, Jiangmen, Huizhou, Yangjiang, Yunfu, Heyuan, Shanwei and Shaoguan), China
	Metric 5:	Currency	Medium	Samples were collected from December 2009 to March 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	187 surface soil samples came from 15 cities and 6 land use types. Of these, 146 samples were collected based on their location on a sampling grid. There were no replicate samples analyzed, but they did composite three surface soil samples from each grid cell sampled.
	Metric 7:	Exposure Scenario	Medium	Samples represent concentrations in an "urban conurbation" in China and were broken out by land use type (residential, industry, landfill, agriculture, forestry, and drinking water source). However, the exposure sources were not well-understood, and there were no control samples.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1 provides median and range, including by land use type; Figure 2 breaks out concentrations by city. Raw data were not provided in the paper or SI, and some summary statistics such as frequency of detection and SD, were missing.
	Metric 9:	Quality Assurance	High	They utilized field and method blanks. They corrected for recovery, which was 106% +/- 12%, and levels measured in blanks (Sec. 2.4).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability is discussed; they compared findings to those of previous studies as well as by land-use type. Uncertainty about sources of the chemical is also briefly discussed, along with possible explanations for the patterns detected. Some study limitations were identified (e.g., the industrial areas were not necessarily areas where the chemicals of interest were produced or used).
Overall Quality Determination			Medium	

Study Citation:		Wang, L., Yang, X., Zhang, A., Bidegain, G., Li, R., Na, G., Yuan, X. (2019.0). Distribution patterns and ecological risk of endocrine-disrupting chemicals at Qingduizi Bay (China): A preliminary survey in a developing maricultured bay. Marine Pollution Bulletin 146:915-920.		
HERO ID:		5691053		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods, equipment, study site, storage conditions reported in detail.
	Metric 2:	Analytical Methodology	High	Extraction and analytical methods, instrument, calibration curve, recovery samples, and LOD reported.
	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 2012.
	Metric 6:	Spatial and Temporal Variability	Medium	31 total samples (15 mariculture ponds and 16 outer bay). No replicates.
	Metric 7:	Exposure Scenario	Medium	Measuring TBBPA in surface water. It is unclear what the exposure source is.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Box plots reported in fig 3. Raw data is reported in supplemental files.
	Metric 9:	Quality Assurance	Medium	QA procedures reported, including procedural blanks. Recoveries ranged from 72.3% to 81.2%, but not specified for TBBPA.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability characterized in different locations sampled. No limitations or uncertainties reported.
Overall Quality Determination			High	

Study Citation:		Lankova, D., Svarcova, A., Kalachova, K., Lacina, O., Pulkrabova, J., Hajslova, J. (2015.0). Multi-analyte method for the analysis of various organohalogen compounds in house dust. Analytica Chimica Acta 854:61-69.		
HERO ID:		5737901		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology is discussed in the data source or companion source and is generally appropriate (i.e., scientifically sound) for the chemical and media of interest, however, sample storage duration is not reported.
	Metric 2:	Analytical Methodology	High	All pertinent sampling information is provided.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Czech Republic
	Metric 5:	Currency	Medium	Samples collected in 2013.
	Metric 6:	Spatial and Temporal Variability	Medium	>10 samples; no replicates
	Metric 7:	Exposure Scenario	Medium	The data closely represent relevant/realistic exposure scenario but is not well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data reported in Table SV.
	Metric 9:	Quality Assurance	High	The QA/QC results are provided including procedural blanks and recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study has limited discussion of key uncertainties, limitations, and data gaps.
Overall Quality Determination			High	

Study Citation:		Shin, H., Moschet, C., Young, T. M., Bennett, D. H. (2019.0). 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 was 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:		Evenset, A., Leknes, H., Christensen, G. N., Warner, N., Remberger, M., Gabrielsen, G. W. (2009.0). Screening of new contaminants in samples from the Norwegian Arctic: Silver, platinum, sucralose, bisphenol A, tetrabrombisphenol A, siloxanes, phthalates (DEHP), phosphororganic flame retardants.		
HERO ID:		6992056		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is clear and appropriate. All relevant details are included. Method is described on pages 15 to 20.
	Metric 2:	Analytical Methodology	High	The analytical methodology is clear and appropriate. Limits of detection are provided in each table.
	Metric 3:	Biomarker Selection	N/A	Study is testing parent chemical presence in the muscle of fish, whole fish, and liver of seabirds.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were taken in the Norwegian Arctic, in the Barents Sea and around Spitsbergen.
	Metric 5:	Currency	Medium	Samples were collected in 2004 and 2008.
	Metric 6:	Spatial and Temporal Variability	Medium	Number of samples varies by media; however, all scenarios have at least three samples. Sediment, fish and birds have at least 6 samples for chemicals of interest. Replicates are not reported.
	Metric 7:	Exposure Scenario	Low	The exposure scenario is not well characterized. Few details on the route of exposure are given.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data is presented in Tables 10, 11, and 12.
	Metric 9:	Quality Assurance	Low	QA/QC measures were not discussed and issues were not identified.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Characterization of variability is absent. No standard deviations or coefficients of variance were provided.
Overall Quality Determination			Medium	

Study Citation:		Green, N. W., Schøyen, M., Hjermann, D. Ø., Ruus, A., Lusher, A., Beylich, B., Lund, E., Tveiten, L., Håvardstun, J., Jenssen, M. T. S., Ribeiro, A. L., Bæk, K. (2021.0). Contaminants in coastal waters of Norway 2017, revised. NIVA-report :0-0.		
HERO ID:		7002448		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Samples of various biota were assessed following publicly available guidelines. The method for collecting and preparing blue mussels was based on the National Standard for mussel collection (NS 9434:2017) but not otherwise described. Coastal Atlantic cod were caught by local fisherman and prepared by NIVA, but specific methodology of sample preparation is not reported. Blood and egg samples were collected from common eider by NIVA. Because specific methodologies are not reported for any sample type, but sampling was carried out by a trusted authoritative source, this metric receives a low score.
	Metric 2:	Analytical Methodology	Medium	Samples were analyzed according to OSPAR guidelines (OSPAR 2003, 2012). Determination of TBBPA via GC-MS was performed by laboratories with accreditation status of ISO 17025, and LOQ is reported for each laboratory. However, no further detail is reported.
	Metric 3:	Biomarker Selection	N/A	This study was testing for the parent chemical of interest in biota along the coast of Norway, which would be considered environmental media relative to a human exposure scenario.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in specific locations across Norway.
	Metric 5:	Currency	High	All sample types were collected between 2017 and 2018.
	Metric 6:	Spatial and Temporal Variability	Low	Pooled samples of 50 individual blue mussels were analyzed from two sampling stations across Norway. Cod livers were analyzed from three sampling stations, using a mixture of pooled and individual samples. Eider blood from 15 individuals and eggs from another 15 individuals were sampled from one station. Duplicate eider blood samples were collected but not reported for cod or mussels. These numbers are summarized in Table 19.
	Metric 7:	Exposure Scenario	High	This study was testing for the parent chemical of interest in biota along the coast of Norway, which would be considered environmental media relative to a human exposure scenario. The coastal Atlantic cod represent a likely exposure source for the local population, based on catches from local fisherman being the source for these samples. It is unclear how likely exposure is from common eider.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data are not reported. Summary statistics presented in Table 19 include median and standard deviation for each sample type for each location.
	Metric 9:	Quality Assurance	Medium	Results were considered acceptable by QUASIMEME Round 2017-1, corresponding to the analyses of the 2016-samples (Green et al. 2017 – M-856(2017)). Internal QA/QC methods were reported to be used in each laboratory but not otherwise specified. Estimated uncertainty was reported to be 30-40%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Quantitative characterization of variability is reported as standard deviation, and trends over time are discussed qualitatively in light of sampling from previous years. However, limitations or uncertainties are not robustly discussed.
Overall Quality Determination			Medium	

Study Citation:		Heimstad, E. S., Nygård, T., Herzke, D., Bohlin-Nizzetto, P. (2019.0). Environmental pollutants in the terrestrial and urban environment, 2018.		
HERO ID:		7002451		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology included location, number of samples, date and sampling strategy were reported in section 2.1 and tables 2,3,4, and 5. Coordinates were reported in Appendix 2.
	Metric 2:	Analytical Methodology	High	LOD was reported in appendix 1, page 174 for a range of matrices. Analytical methodology for phenolic compounds was reported in page 36.
	Metric 3:	Biomarker Selection	N/A	Analysis of TBBPA was conducted in a range of environmental samples including soil, eggs and biological media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Data were collected in Norway. Location coordinates were reported in Appendix 2.
	Metric 5:	Currency	High	Samples were collected in 2018.
	Metric 6:	Spatial and Temporal Variability	Medium	Number of samples per media were reported in table 2. The number of samples ranged from 5 to 10. Sample replicates were only reported for analytical methods.
	Metric 7:	Exposure Scenario	High	Analysis of next 20 chemicals were in several trophic levels of a terrestrial food web in Norway, closely representing relevant exposure scenario.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Individual data points were reported in appendix 1. Summary data of phenols were reported in table 18 (mean, min and max). Detection rate was reported in table 6.
	Metric 9:	Quality Assurance	High	QA was well described in page 36, the study used SEM, laboratory blanks, procedural blanks, replicates and field blanks.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Recommendations for continuing the monitoring program were reported in page 104. Sample variability for TBBPA was not reported since concentrations were <LOD for almost all samples
Overall Quality Determination			High	

Study Citation:		Norwegian Environment Agency, (2019.0). Monitoring of environmental contaminants in freshwater ecosystems 2018 - Occurrence and biomagnification.		
HERO ID:		7002468		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology including equipment, location and time is reported in section 2.1 on page 20.
	Metric 2:	Analytical Methodology	Medium	Analytical methodology for TBBPA is reported on page 23, section 2.2.5. LOD is reported in appendix A (raw data for 2018).
	Metric 3:	Biomarker Selection	N/A	Concentrations of TBBPA were measured in zooplankton, Mysis, E.smelt, Vendance and Brown trout.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Lake Mjosa and Lake Femunden in Norway. Location coordinates are reported in table 1 and table 2.
	Metric 5:	Currency	High	Samples were collected in 2018.
	Metric 6:	Spatial and Temporal Variability	Medium	Number of samples ranged from 3-15 and there were no sample replicates.
	Metric 7:	Exposure Scenario	High	TBBPA concentrations was measured in a freshwater ecosystems in two large lakes in Norway. One lake had with several sources of contamination including urban, industrial, wastewater treatment plans and agricultural. The other lake did not have any important contamination sources.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data is reported in appendix A. Summary of statistics is shown in figure 22 and detection frequency is reported in table 4.
	Metric 9:	Quality Assurance	Medium	The study doesn't report clear QA/QC procedures, but it can be implied by the use of standardized methods by the Norwegian Institute for Water Research.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Key limitations are not reported and variability for TBBPA isnot reported due to the low detection frequency
Overall Quality Determination			High	

Study Citation:		Norwegian Environment Agency, (2019.0). Environmental contaminants in an urban fjord, 2018.		
HERO ID:		7002475		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Table 1 gives an overview of the samples collected, matrix, locality, frequency and No. for analysis.
	Metric 2:	Analytical Methodology	High	Brominated flame retardants reported in section 2.2.3 page 25. LOD for TBBPA reported in table 10 for sediment, herring gull blood and eggs table 12, storm water and effluent water (table 14).
	Metric 3:	Biomarker Selection	N/A	TBBPA measured in sediment (table 10), herring gull blood and egg (table 12), storm water and effluent water (table 14).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected in Oslofjord, Oslo, Norway. Figure 1 A and B reports the sample location.
	Metric 5:	Currency	High	Sampling was conducted in 2018.
	Metric 6:	Spatial and Temporal Variability	Medium	No sample replicates reported, sample size ranged from 1 (composite of 4 grabs) to 15 (see table 1).
	Metric 7:	Exposure Scenario	High	Monitoring of the anthropogenic chemicals discharged into a fjord system and the implications on the fjord ecosystem, including food web, water and sediment.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data is not reported, data reported as range and mean for blood and egg samples, water and sediment reported as one data point.
	Metric 9:	Quality Assurance	Low	Recoveries are not reported, the laboratories that conducted the study are accredited for ISO/IEC 17025.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability reported in terms of matrices, key limitations not reported.
Overall Quality Determination			Medium	

Study Citation:		Heimstad, E. S., Nygård, T., Herzke, D., Bohlin-Nizzetto, P. (2018.0). Environmental pollutants in the terrestrial and urban environment, 2017.		
HERO ID:		7296058		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	All sample collection (soil, terrestrial biota) included adherence to a publicly available SOP that is scientifically sound and widely accepted, "Guidelines for field work in connection with environmental monitoring" (JAMP; OSPAR, 2009).
	Metric 2:	Analytical Methodology	Low	Samples were analyzed by accredited laboratories (NINA, NIVA, and NILU), so it is assumed that scientifically sound analytical methods were conducted. Procedures are described on pages 36-39. However, while LOD and LOQ are referenced throughout the report, the specific values for these limits are not stated.
	Metric 3:	Biomarker Selection	N/A	The study tested for the parent chemical in environmental media (soil, terrestrial biota).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Oslo, Norway.
	Metric 5:	Currency	High	The samples were collected in 2017 (June to September).
	Metric 6:	Spatial and Temporal Variability	Medium	Soil, and terrestrial biota samples were collected from up to 10 locations in Oslo, Norway. Number of samples for each sample type ranged from 3 to 10, and specific sample number and sampling strategy (e.g., pooled vs. individual) are reported for each. However, use of replicates was not reported.
	Metric 7:	Exposure Scenario	High	This study collected soil and terrestrial biota samples from well documented areas around Oslo, Norway to characterize concentrations of the chemical of interest in several trophic levels of a terrestrial food web. As a result, the context of each sample type is well documented and easily extrapolated to other scenarios.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data is reported in Appendix 1 pages 209 to 214. Summary statistics were not reported due to low detection.
	Metric 9:	Quality Assurance	High	The study applied QA/QC measures by following international requirements for QA/QC, e.g., recommendations of the Arctic Monitoring and Assessment Programme (AMAP) and the requirements in the European quality norm EN 17049. Additionally, samples were analyzed by accredited laboratories (NINA, NIVA, and NILU).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability is not characterized quantitatively or qualitatively due to low detection levels. Uncertainty is not discussed.
Overall Quality Determination			Medium	

Study Citation:		COWI AS, (2018.0). Screening programme 2017: Suspected PBT compounds. :0-0.		
HERO ID:		7303021		
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling Methodology	High	The sampling methodology is clear and appropriate. Details such as sample storage, sampling protocol, and sampling personnel were described.
	Metric 2:	Analytical Methodology	Low	The analytical methodology is clear and appropriate; however, the LOQ is not provided. The calculation to obtain the LOQ is described, but the LOQ itself is not given.
	Metric 3:	Biomarker Selection	N/A	Study is testing for parent chemical in an environmental media.
Domain 2: Representativeness	Metric 4:	Geographic Area	High	Samples were collected in Norway.
	Metric 5:	Currency	High	Samples were collected in 2017.
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Samples size is not provided for all media.
	Metric 7:	Exposure Scenario	Medium	The exposure scenario is the parent chemical in marine and freshwater environments. Although this is a scenario of interest, the exposure pathway is not well characterized.
Domain 3: Accessibility/Clarity	Metric 8:	Reporting of Results	High	Data are provided in the attachments section. Some of the data is clearly raw data; while other data are unclear.
	Metric 9:	Quality Assurance	Medium	The use of controls and blanks is reported in the methods and results section. QA/QC issues were not identified.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The characterization of variability is absent. No standard deviations were provided.
Overall Quality Determination			Uninformative	

Study Citation:		Richter, H., Lorenz, W., Bahadir, M. (1997). Examination of organic and inorganic xenobiotics in equipped printed circuits. Chemosphere 35(1-2):169-179.		
HERO ID:		1486884		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling Methodology and Conditions	High	Sampling methods were not from a SOP, but were clear and appears to be scientifically sound.
	Metric 2:	Analytical Methodology	High	Analytical methods are clear and appropriate and contained pertinent information.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative	Metric 4:	Testing Scenario	Medium	Conditions would be relevant to electronic waste exposure, but did not included samples taken at different times (no variation in microenvironment) and was only for commercial electronics. Could be different from personal electronic recycling.
	Metric 5:	Sample Size and Variability	Low	While looked at 34 components, no replicate test were performed.
	Metric 6:	Temporality	Low	Samples taken >15 years ago
Domain 3: Accessibility/Clarity	Metric 7:	Reporting of Results	Low	Figure 3 does have the moiety of TBBPA for each fraction but the values are not reported
	Metric 8:	Quality Assurance	Low	QA/QC measures were not directly discussed but can be implied through the study's laboratory protocols
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Low	Very limited discussion on key uncertainties, limitations, and data gaps.
Overall Quality Determination		Low		

Study Citation:		Zhou, X., Guo, J., Lin, K., Huang, K., Deng, J. (2013). Leaching characteristics of heavy metals and brominated flame retardants from waste printed circuit boards. Journal of Hazardous Materials 246-247:96-102.		
HERO ID:		1789485		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	Medium	Sample collection and preparation were generally well-described for waste printed circuit boards.
	Metric 2:	Analytical Methodology	High	Analytical methodology includes extraction, instrumentation, LODs, surrogate recoveries. TCLP and SPLP leach tests are EPA procedures.
	Metric 3:	Biomarker Selection	N/A	NA - biomarker not used
Domain 2: Representative				
	Metric 4:	Testing Scenario	Medium	Representative of domestic and imported e-waste in China; may not be representative of US practices.
	Metric 5:	Sample Size and Variability	Medium	5 samples, separated into 3 size fractions (5 samples for each fraction). Triplicate analysis for leach tests.
	Metric 6:	Temporality	Medium	5-15 yrs old - e-waste sample collection date was not specified, but monitoring samples were collected in 2011.
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	Raw data not reported. Summary statistics for WPCB include mean and std. dev. Summary statistics for leach test concentrations include mean and range.
	Metric 8:	Quality Assurance	Medium	QA/QC measures included surrogate recoveries and blanks. Triplicate leach tests were performed (but all TBBPA results were below detection limit).
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Medium	Variability was characterized. Uncertainties, limitations and data gaps were discussed - it was noted that only the unreacted residual TBBPA in the waste matrix was determined.
Overall Quality Determination			Medium	

Study Citation:		Wäger, P. A., Schluep, M., Müller, E., Gloor, R. (2012). RoHS regulated substances in mixed plastics from waste electrical and electronic equipment. Environmental Science & Technology 46(2):628-635.		
HERO ID:		1927621		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	High	detailed sampling description with references cited
	Metric 2:	Analytical Methodology	High	method referenced with description of modifications; calibration range & DLs provided
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative				
	Metric 4:	Testing Scenario	Medium	representative of waste stream of consumer electronics and electrical appliances in Switzerland
	Metric 5:	Sample Size and Variability	High	1-7 samples per waste type; 10+ samples per waste category
	Metric 6:	Temporality	Medium	Study appears to be initiated or conducted in 2008; published in 2012
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	raw data provided in SI; conc data presented in graphical form and some results for certain waste types described in the text with average and max.
	Metric 8:	Quality Assurance	Medium	duplicate analysis performed for subset of samples
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	High	range of uncertainty for determination of BFRs using method was reported and discussed
Overall Quality Determination			High	

Study Citation:		Kajiwara, N., Noma, Y., Takigami, H. (2011). Brominated and organophosphate flame retardants in selected consumer products on the Japanese market in 2008. Journal of Hazardous Materials 192(3):1250-1259.		
HERO ID:		1927630		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	Medium	The paper describes the sampling methodology; however, the paper does not provide any information about the sample storage time or conditions.
	Metric 2:	Analytical Methodology	Medium	The paper does not provide a reference for the analytical method, but it was described in the text. Percent recoveries were provided but the paper does not mention method validation. Verification of extraction efficiency was done for a different analyte. LODs only given for samples with conc <LOD.
	Metric 3:	Biomarker Selection	N/A	No biomarker information presented in the study.
Domain 2: Representative				
	Metric 4:	Testing Scenario	Medium	The study tested a variety of consumer products.
	Metric 5:	Sample Size and Variability	Low	The study did not mention the use of sample replicates; but single samples were collected from 2 types of curtains, 4 wall papers, 2 electrical outlets, and 2 insulation boards. Single samples of a variety of components from electronic equipment (2 tvs, 1 computer) were collected.
	Metric 6:	Temporality	Medium	All of the materials sampled in this study were bought new in 2008.
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	Data for individual samples were provided. A statistical summary was not provided.
	Metric 8:	Quality Assurance	Medium	The authors state that established laboratory QC procedures were used but only provided a brief description about them.
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Low	No measures of variability were reported. The study measured concentration of flame retardants in consumer products. This study was more of a survey of a variety of items rather than a definitive characterization for a specific consumer product.

Overall Quality Determination**Medium**

Study Citation:		Takigami, H., Suzuki, G., Hirai, Y., Sakai, S. (2008). Transfer of brominated flame retardants from components into dust inside television cabinets. Chemosphere 73(2):161-169.		
HERO ID:		1927735		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	High	sampling description provided
	Metric 2:	Analytical Methodology	High	med-high/stated that LODs are provided in SI
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative				
	Metric 4:	Testing Scenario	High	older tvs used/Japanese study
	Metric 5:	Sample Size and Variability	Medium	tested 5 tvs, 3 components/locations + dust samples for each. Does not appear that replicate samples were collected/analyzed.
	Metric 6:	Temporality	Low	tvs used until 2005 (manufactured pre-2005)
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	High	conc. provided for individual samples; statistics incl. mean, range, number of samples w/TBBPA quantitated.
	Metric 8:	Quality Assurance	High	acceptable blank and surrogate recovery results were described
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Medium	limited discussion of uncertainty; makes recommendations for further research
Overall Quality Determination			High	

Study Citation:		Saito, I., Onuki, A., Seto, H. (2007). Indoor organophosphate and polybrominated flame retardants in Tokyo. Indoor Air 17(1):28-36.		
HERO ID:		1927779		
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling Methodology and Conditions	Medium	Sample storage not discussed. Passive absorption IPA method was used for the apartment migration test.
	Metric 2:	Analytical Methodology	High	Sample analysis was done using GC-FPD and GC-AED. The paper describes LODs, recoveries, as spiking of samples in the QA section.
	Metric 3:	Biomarker Selection	N/A	A biomarker was not used in the study.
Domain 2: Representative	Metric 4:	Testing Scenario	Medium	Building materials and electronic products are relevant scenarios.
	Metric 5:	Sample Size and Variability	Medium	Samples consisted of 7 computer monitors and 8 tv sets. Appears to be 1 sample each for migration rate from wall coverings and ceiling and 2 for flooring.
	Metric 6:	Temporality	Low	The electronics were manufactured between 1989 and 2002. The floors and wall coverings are from 2001.
Domain 3: Accessibility/Clarity	Metric 7:	Reporting of Results	Low	TBBPA was not detected in any of the test samples. The detection limits and number of samples were provided.
	Metric 8:	Quality Assurance	Medium	The study included blanks, recovery studies, breakthrough tests, and duplicates. The duplicates were only for flooring.
Domain 4: Variability and Uncertainty	Metric 9:	Variability and Uncertainty	Low	All samples were non-detects for TBBPA. A standard deviation is provided for the recovery study (n=3). Includes some discussion of uncertainty but not specific to TBBPA.
Overall Quality Determination			Medium	

Study Citation:		Morf, L. S., Tresp, J., Gloor, R., Huber, Y., Stengele, M., Zennegg, M. (2005). Brominated flame retardants in waste electrical and electronic equipment: substance flows in a recycling plant. Environmental Science & Technology 39(22):8691-8699.		
HERO ID:		1927802		
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling Methodology and Conditions	Medium	Table 1 gives overview of sample type by location; detailed description of substance flow analysis & sampling is in SI; there was no info on sample storage
	Metric 2:	Analytical Methodology	Low	While SI provides detailed description, there is no citation for methodology and LODs are not reported.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative	Metric 4:	Testing Scenario	Medium	Large waste stream of small electrical/electronic equipment at recycling facility is representative of consumer materials in Switzerland but not an exposure setting.
	Metric 5:	Sample Size and Variability	High	20 grab samples were collected per composite. 2-6 composites collected for each pollution type and 2-4 composites were analyzed.
	Metric 6:	Temporality	Low	Sampled in 2003
Domain 3: Accessibility/Clarity	Metric 7:	Reporting of Results	Medium	Raw data were not reported. Table 2 provides total SWEEE waste stream mean and uncertainty in mg/kg & % for 95% confidence level; Table 3 reports by type of product.
	Metric 8:	Quality Assurance	Medium	SI provides concentration for each output fraction (by size), including external QA (2-4 replicates for 7 samples) performed by outside labs.
Domain 4: Variability and Uncertainty	Metric 9:	Variability and Uncertainty	High	95% confidence level was reported. QA includes 2-4 replicates using various methods and includes discussion of uncertainty
Overall Quality Determination			Medium	

Study Citation: Rani, M., Shim, W. J., Han, G. M., Jang, M., Song, Y. K., Hong, S. H. (2014). Hexabromocyclododecane in polystyrene based consumer products: An evidence of unregulated use. Chemosphere 110:111-119.				
HERO ID: 2343697				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling Methodology and Conditions	High	Sampling methods were reported and appear scientifically sound.
	Metric 2:	Analytical Methodology	Medium	Analytical methods are reported and appear scientifically appropriate. LOD or limits not reported. QC/QA reported and described.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative	Metric 4:	Testing Scenario	High	Testing conditions appear to be relevant to consumer exposure; Multiple different products were tested
	Metric 5:	Sample Size and Variability	High	34 products were tested; products were included for three polystyrene type (EPS, XPS, and Extruded PS); replicates and blanks were included
	Metric 6:	Temporality	Medium	Sampled products were from between 4-10 years ago.
Domain 3: Accessibility/Clarity	Metric 7:	Reporting of Results	Medium	raw data not reported (could not access supplemental to check) but did report mean and sd
	Metric 8:	Quality Assurance	Medium	QA/QC explained; included replicate and procedural blanks, but missing detection limits.
Domain 4: Variability and Uncertainty	Metric 9:	Variability and Uncertainty	Medium	Some discussion included on variability and uncertainty
Overall Quality Determination			High	

Study Citation:		Gallen, C., Banks, A., Brandsma, S., Baduel, C., Thai, P., Eaglesham, G., Heffernan, A.,my, Leonards, P.,im, Bainton, P., Mueller, J. F. (2014). Towards development of a rapid and effective non-destructive testing strategy to identify brominated flame retardants in the plastics of consumer products. Science of the Total Environment 491(Special Issue):255-265.		
HERO ID:		2689371		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Con- ditions	High	Three sampling methods (XRF, surface wipes, and destructive analysis) all described and valid
	Metric 2:	Analytical Methodology	High	Analytical methods described for all three tests with instrumentation, recovery samples, calibration, surface wipe LODs and LOQs given
	Metric 3:	Biomarker Selection	N/A	Biomarker not used
Domain 2: Representative				
	Metric 4:	Testing Scenario	High	Consumer products likely to contain TBBPA include electronics, toys, furniture, baby accessories, car acces- sories, and more.
	Metric 5:	Sample Size and Variability	High	Variety of products sampled, with n ~ 48 for surface wipes and destructive testing; some replicates for surface wipe and destructive analysis
	Metric 6:	Temporality	Medium	Tested consumer products were those that were for sale in Australia in October 2012; may differ to some extent from more recent American products
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	High	Some summary statistics available in study; SI file reports raw results for destructive chemical analysis (ug/g TBBPA) for each product sampled; concentrations also converted to weight fractions
	Metric 8:	Quality Assurance	High	Authors employed a variety of QA/QC measures, including blanks and qc samples, recoveries of surface spike tests
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	High	Variability in products and testing methods are captured and uncertainties are addressed; false posi- tives/negatives are discussed for samples where TBBPA was measured in one test but not the other; limitations of XFR and surface wipes discussed in detail in SI file
Overall Quality Determination			High	

Study Citation:		La Guardia, M. J., Hale, R. C. (2015). Halogenated flame-retardant concentrations in settled dust, respirable and inhalable particulates and polyurethane foam at gymnastic training facilities and residences. Environment International 79:106-114.		
HERO ID:		3012534		
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling Methodology and Conditions	Medium	Adequate discussion of sampling of foam blocks from gym pits; some description of composite sample creation
	Metric 2:	Analytical Methodology	Medium	Adequate discussion of approved analytical methods for extraction, purification and analysis using UPLC-APPI/MS; multiple media discussed; additional detail found in a prior publication
	Metric 3:	Biomarker Selection	N/A	A biomarker was not used in this study.
Domain 2: Representative	Metric 4:	Testing Scenario	Medium	Exposure to foam is highly applicable, however, activity level varies
	Metric 5:	Sample Size and Variability	Medium	Study had a small sample size. Samples 4a-4e samples were in triplicate and sample 2a was as a composite sample.
	Metric 6:	Temporality	High	The study was published in 2015.
Domain 3: Accessibility/Clarity	Metric 7:	Reporting of Results	Medium	Raw data is provided for the foam block (sample 2a). Triplicate averages are provided for the other samples. The FR composition between each of the six blocks varied substantially. TBBP-A was not detected in the foam blocks above the detection limits.
	Metric 8:	Quality Assurance	Medium	The study included triplicate or composite sampling, low percent RSD, and five-point calibration curves constructed from analytical standards. A laboratory blank was analyzed with each sample set. All results were corrected for surrogate recoveries, except where interferences were encountered.
Domain 4: Variability and Uncertainty	Metric 9:	Variability and Uncertainty	Medium	Small sample size from two gyms does not allow for in-depth discussion. Analysis notes the FR composition between each of the six blocks varied substantially.
Overall Quality Determination			Medium	

Study Citation:		Keller, A. S., Raju, N. P., Webster, T. F., Stapleton, H. M. (2014). Flame Retardant Applications in Camping Tents and Potential Exposure. Environ-mental Science & Technology Letters 1(2):152-155.		
HERO ID:		3023922		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Con-ditions	Medium	Some discussion of sampling methodology; not a commonly practiced sampling of tents, therefore referencing methods from other prior studies; additional methodology information found in the SI file
	Metric 2:	Analytical Methodology	Medium	Some discussion of analytical methodology, approved GC/MS analysis conducted; makes reference to methods from other prior studies; additional methodology information found in the SI file
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative				
	Metric 4:	Testing Scenario	Low	somewhat relevant consumer exposure scenario; could be extrapolated to other materials defined by the U.S. industrial flammability standard known as CPAI-84
	Metric 5:	Sample Size and Variability	Medium	Adequate sample size per scenario: 11 fabric tent samples, some variability in tent capacity, label, and year purchased (though some information missing); however the fabric samples are not paired with users; separately conducted, a study of tent and hand wipes are paired
	Metric 6:	Temporality	Medium	collection took place over a month; within 5-15 years old
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	raw data for one tent fabric analysis; not detected in hand wipes; tent wipes: mean and range reported; MDL calculated but not reported, only referenced as a minimum; would be more meaningful to connect each tent wipe to a tent age/description
	Metric 8:	Quality Assurance	Low	MDL described: method detection limit was set to 3 times the standard deviation of the laboratory blank values for a respective analyte; detected in blanks; all sample values were blank-corrected;
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Low	Minimal discussion; Weaknesses include the small sample size and convenience sampling.
Overall Quality Determination			Low	

Study Citation:		Choi, K. I., Lee, S. H., Osako, M. (2009). Leaching of brominated flame retardants from TV housing plastics in the presence of dissolved humic matter. Chemosphere 74(3):460-466.		
HERO ID:		3809190		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling Methodology and Conditions	High	Brief description of sampling methodology provided.
	Metric 2:	Analytical Methodology	Medium	Samples were analyzed using HRGC/HRMIS. Method used was not cited. Instrument calibration not mentioned. Limit of detection was provided.
	Metric 3:	Biomarker Selection	N/A	No biomarker
Domain 2: Representative	Metric 4:	Testing Scenario	High	Testing scenario for leaching TBBPA from TV housing plastics was clearly defined.
	Metric 5:	Sample Size and Variability	Low	Sample size was not clearly defined. Samples were described as pre-molded high-impact polystyrene pellets. They used 100 g plastic samples per 10 L solution. The graphs showing the leaching results only shows one data point for each of four days tested. Text states that batch leaching tests were performed twice a day (duplicates?).
	Metric 6:	Temporality	Low	TV housing plastic samples were obtained in 2002.
Domain 3: Accessibility/Clarity	Metric 7:	Reporting of Results	Low	There are some reporting errors with the table headers in the report. Report does mention the concentration of TBBPA in the plastic pellets and provides leaching results in graph form (figure titles are incorrect).
	Metric 8:	Quality Assurance	Low	quality assurance was not directly discussed.
Domain 4: Variability and Uncertainty	Metric 9:	Variability and Uncertainty	Medium	The study tested leaching over four days and two leaching media and multiple chemicals. TBBPA leaching concentrations were presented for each day tested and for both distilled water and DHM solutions.
Overall Quality Determination		Medium		

Study Citation:		Sindiku, O., Babayemi, J., Osibanjo, O., Schlummer, M., Schluep, M., Watson, A., Weber, R. (2015). Polybrominated diphenyl ethers listed as Stockholm Convention POPs, other brominated flame retardants and heavy metals in e-waste polymers in Nigeria. Environmental Science and Pollution Research 22(19):14489-14501.		
HERO ID:		4159657		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	High	Sampling procedures described in detail; additional sampling information is provided in the Supplemental Information
	Metric 2:	Analytical Methodology	Medium	Analytical methodology clear and appropriate. Plastic samples first screened for bromine using XRF. Samples testing positive for bromine were extracted and further analyzed for TBBPA by GC/ECD. Selected samples analyzed by GC/MS. LOD reported for bromine. LOQs for BFRs calculated but not reported.
	Metric 3:	Biomarker Selection	N/A	
Domain 2: Representative				
	Metric 4:	Testing Scenario	High	Testing closely represents relevant exposure scenario (product concentrations/weight fractions)
	Metric 5:	Sample Size and Variability	Medium	Sample size was large (TBBPA found in 101 computer samples and 8 TV samples). Replicate testing was not reported.
	Metric 6:	Temporality	Medium	Product manufacture cut-off date was 2006, products were sampled in 2011.
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	Ranges and average product concentrations in percentages of TBBPA in computer and TVs reported in the text; additional data may be reported in the Supporting Information (Table SI 4); however, the Supporting Information was not available at the time of data evaluation.
	Metric 8:	Quality Assurance	High	The study applied QA/QC measures. BFR analysis conducted according to IEC-62328-2008. GC/ECD calibrated before each use. Blank injections used to check for contamination.
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Low	Key uncertainties & limitations are not discussed.
Overall Quality Determination			Medium	

Study Citation:		Tasaki, T., Takasuga, T., Osako, M., Sakai, S. (2004). Substance flow analysis of brominated flame retardants and related compounds in waste TV sets in Japan. Waste Management 24(6):571-580.		
HERO ID:		4160103		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	Medium	limited description of tvs sampled and methodology; mixed with descriptions of previous studies
	Metric 2:	Analytical Methodology	Medium	analytical methodology for determining TBBPA in tv covers is described but some details are missing: calibration and recoveries
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative				
	Metric 4:	Testing Scenario	Medium	BFRs/TBBPA in Japanese tvs 1984-1998, disposal.
	Metric 5:	Sample Size and Variability	Low	Table 3 says n=1 for each of 3 time periods, but each sample is a mix of 9 tvs. Specifics not provided in sampling description.
	Metric 6:	Temporality	Low	tvs manufactured 1984-1998
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	TBBPA content (conc.) in tv rear cover provided along with quantitation limit. No summary statistics.
	Metric 8:	Quality Assurance	Low	No discussion of QA/QC for TBBPA analysis of tv covers
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Low	std dev reported for wt proportions & BR content but not for relevant TBBPA analysis
Overall Quality Determination			Low	

Study Citation:		Yu, D., Duan, H., Song, Q., Liu, Y., Li, Y., Li, J., Shen, W., Luo, J., Wang, J. (2017). Characterization of brominated flame retardants from e-waste components in China. Waste Management 68:498-507.		
HERO ID:		4162199		
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling Methodology and Conditions	High	Sampling methods were described and followed publicly available technical specifications.
	Metric 2:	Analytical Methodology	High	Analytical methods were described and referenced.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative	Metric 4:	Testing Scenario	Medium	Two different recycling centers in China were used and likely to be similar to exposures in the US.
	Metric 5:	Sample Size and Variability	High	Composite samples were collected per product type; 19 samples of housing plastics and 6 samples of printed circuit boards. Every sample was analyzed twice.
	Metric 6:	Temporality	High	Samples within 5 years
Domain 3: Accessibility/Clarity	Metric 7:	Reporting of Results	Medium	Figures 5 and 6 and the text report concentrations in individual samples and the mean concentration per product category.
	Metric 8:	Quality Assurance	High	QA/QC discussed and reported use of blanks.
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Medium	Some discussion on variability and uncertainty was included.
Overall Quality Determination			High	

Study Citation:		Miyake, Y., Tokumura, M., Nakayama, H., Wang, Q., Amagai, T., Ogo, S., Kume, K., Kobayashi, T., Takasu, S., Ogawa, K., Kannan, K. (2017). Simultaneous determination of brominated and phosphate flame retardants in flame-retarded polyester curtains by a novel extraction method. Science of the Total Environment 601-602:1333-1339.		
HERO ID:		4175610		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling Methodology and Conditions	Medium	Sampling methods described and sound, not all conditions provided but key parameters are detailed.
	Metric 2:	Analytical Methodology	Medium	Methods and instrumentation described in detail, recoveries of 91–121% for BFRs and 82–122% for PFRs and calculation of LOQ given but not LOD.
	Metric 3:	Biomarker Selection	N/A	Biomarker was not used.
Domain 2: Representative	Metric 4:	Testing Scenario	Medium	Flame-retarded curtains are a consumer product that could reasonably create an exposure scenario, but the 40 curtains sampled may be specific to the Japanese market.
	Metric 5:	Sample Size and Variability	Low	There were 40 samples taken per chemical (one for each curtain) and no replicates.
	Metric 6:	Temporality	Medium	Curtains sampled are from those available on the market in 2014.
Domain 3: Accessibility/Clarity	Metric 7:	Reporting of Results	Medium	The supplemental information file provides raw concentration for curtain samples by chemical but no summary statistics. There are only five compounds detected in all of the samples.
	Metric 8:	Quality Assurance	Medium	QA/QC discussed and addressed with recovery tests with fortified blank samples.
Domain 4: Variability and Uncertainty	Metric 9:	Variability and Uncertainty	Medium	Some variability discussed in the curtain types and differences between the proposed method and dissolution method. Some uncertainties discussed in the lack of quantifiable data and positing novel compounds.
Overall Quality Determination		Medium		

Study Citation:		Pivnenko, K., Granby, K., Eriksson, E., Astrup, T. F. (2017). Recycling of plastic waste: Screening for brominated flame retardants (BFRs). Waste Management 69:101-109.		
HERO ID:		4182904		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	High	Adequate discussion of sampling methodology and pre-treatment process
	Metric 2:	Analytical Methodology	High	Adequate description of analytical methods HPLC and MS/MS; Sample extraction and analysis were performed in accordance with a modified accredited method FC412.1
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical.
Domain 2: Representative				
	Metric 4:	Testing Scenario	High	Relevant and likely source of exposure
	Metric 5:	Sample Size and Variability	High	A large sample size of household waste samples and processed plastics obtained from virgin production and recycling; several scenarios found within each group; adequate description of the collected samples
	Metric 6:	Temporality	Medium	2013 sampling; 5-15 years old
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	High	Raw data; LOD and FOD reported
	Metric 8:	Quality Assurance	Medium	Some discussion of standard lab QA/QC; Concentrations were not compensated for the method recovery; calibration standards used; Sample extraction and analysis were performed in accordance with a modified accredited method FC412.1
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Medium	Some discussion of variability across sample types; discussed TBBPA containing recycled plastics have no significant removal or degradation of TBBPA during plastic recycling process
Overall Quality Determination			High	

Study Citation:		Qian, Z., Xu, Y., Zheng, C., Zhang, A., Sun, J. (2019). Enhanced emissions of brominated flame retardants from indoor sources by direct contact with dust. Environmental Monitoring and Assessment 191(3):170.		
HERO ID:		5043411		
Domain		Metric	Rating	Comments
Domain 1: Reliability		Metric 1: Sampling Methodology and Conditions	Medium	Sampling procedures cited (Rauert and Harrad 2015) and mostly detailed, including equipment, conditions, etc.
	Metric 2:	Analytical Methodology	Low	Analytical methods detailed and citation provided (Sun et al 2016) but LODs/LOQs not provided; citation given for TBBPA derivatization procedure but not detailed
	Metric 3:	Biomarker Selection	N/A	No biomarker used
Domain 2: Representative		Metric 4: Testing Scenario	Medium	Cotton sound insulation is a reasonable consumer exposure scenario; tested with and without dust under one set of climate conditions.
	Metric 5:	Sample Size and Variability	Medium	TBBPA only sampled in cotton sound insulation for three replicates with and without dust contact; amount of dust and particle size of dust also tested for cotton sound insulation; variability across replicates captured in standard deviations and error bars in graphs
	Metric 6:	Temporality	High	2019 study; consumer materials assumed to be purchased at time of study
Domain 3: Accessibility/Clarity		Metric 7: Reporting of Results	Medium	Mean and standard deviations reported of three replicates; individual data points (raw data) not provided
	Metric 8:	Quality Assurance	High	QA/QC measures detailed, including controls and replicates, breakthrough and sampling efficiency, and recoveries 85-106%.
Domain 4: Variability and Uncertainty		Metric 9: Variability and Uncertainty	Medium	Variability discussed in particle size and amount of dust coverage; consideration of surface area and cleaning activities discussed as limitation of the findings
Overall Quality Determination			Medium	

Study Citation:		Sun, J., Chen, Q., Han, Y., Zhou, H., Zhang, A. (2018). Emissions of selected brominated flame retardants from consumer materials: the effects of content, temperature, and timescale. Environmental Science and Pollution Research 25(24):24201-24209.		
HERO ID:		5043501		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	High	Sampling methods described and based on previously published methods
	Metric 2:	Analytical Methodology	Medium	Analytical methods described and referenced, however only range of LODs for all chemicals provided, LOD specific to TBBPA not provided.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference
Domain 2: Representative				
	Metric 4:	Testing Scenario	High	Chamber test includes different consumer materials and temperatures
	Metric 5:	Sample Size and Variability	High	Six different materials were tested, each with 3 replicate samples
	Metric 6:	Temporality	Medium	Samples were taken from materials between 5-15 years ago.
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	Raw data were not reported
	Metric 8:	Quality Assurance	High	QA/QC practices described; included 3 replicates and blanks
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	High	Variability and uncertainty were discussed
Overall Quality Determination			High	

Study Citation:		Wu, Y., Miller, G. Z., Gearhart, J., Romanak, K., Lopez-Avila, V., Venier, M. (2019). Children’s car seats contain legacy and novel flame retardants. Environmental Science & Technology Letters 6(1):14-20.		
HERO ID:		5167126		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	Medium	Study provides a good description of the sampling methodology. the sampling and product information is available in the supplemental material.
	Metric 2:	Analytical Methodology	High	The study provides detailed analytical method descriptions including the LODs.
	Metric 3:	Biomarker Selection	N/A	A biomarker was not used in this study.
Domain 2: Representative				
	Metric 4:	Testing Scenario	Medium	A variety of car seats were tested under one set of conditions.
	Metric 5:	Sample Size and Variability	High	There were 18 car seats, 31 fabric samples (including 16 laminated foam/fabric composites) and 5 foam samples.
	Metric 6:	Temporality	High	The car seats were manufactured between 2017 and 2018.
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	High	The number of samples, detection frequencies, minimum, maximum, mean, and median are provided in the study. The supplemental information file provides raw data for 18 samples and LOD.
	Metric 8:	Quality Assurance	High	Procedural blank concentrations and matrix spike recoveries are provided in the study.
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Medium	Limited discussion of uncertainty, but raw data show duplicate samples from same car seats.
Overall Quality Determination			High	

Study Citation:		Gomes, G., Ward, P., Lorenzo, A., Hoffman, K., Stapleton, H. M. (2016). Characterizing flame retardant applications and potential human exposure in backpacking tents. Environmental Science & Technology 50(10):5338-5345.		
HERO ID:		5176516		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	High	Sampling methodology is clearly described and appropriate, including sampling materials, equipment, conditions, procedures and storage. Reference citations are also provided for wipes (Stapleton et al 2008) and air (Allen et al 2007).
	Metric 2:	Analytical Methodology	Low	Analytical methodology for screening analysis (for tent textiles) is briefly described, with reference citation (Stapleton et al 2011). MDL was not reported.
	Metric 3:	Biomarker Selection	N/A	A biomarker was not used in this study.
Domain 2: Representative				
	Metric 4:	Testing Scenario	Medium	Materials selected for testing appear representative of US-produced camping tents.
	Metric 5:	Sample Size and Variability	High	Tent fabrics were from 4 locations of 5 tents were tested.
	Metric 6:	Temporality	Medium	Testing was conducted in 2014.
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Critically Deficient	TBBPA was an analyte for preliminary screening, but no quantitative results or detection limits were provided, and no followup analysis was performed -contextual for absence of chemical.
	Metric 8:	Quality Assurance	Critically Deficient	QA/QC was not described for screening tests.
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Critically Deficient	No quantitative results were reported for TBBPA, so uncertainty is unacceptably high.
Overall Quality Determination			Uninformative	

Study Citation:		Li, Y., Chang, Q., Duan, H., Liu, Y., Zhang, J., Li, J. (2019). Occurrence, levels and profiles of brominated flame retardants in daily-use consumer products on the Chinese market. Environmental Science: Processes & Impacts 21(3):446-455.		
HERO ID:		5202609		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	High	Sampling of consumer products (selection of products) and classifications described.
	Metric 2:	Analytical Methodology	Medium	screening samples briefly described using X-ray fluorescence (SRF) spectrometer; not all details provided (e.g. temperature). Soxhlet method identified for TBBPA, including reference to "method described in our previous studies with minor modifications"; LCMS procedures detailed
	Metric 3:	Biomarker Selection	N/A	No biomarker was used
Domain 2: Representative				
	Metric 4:	Testing Scenario	Medium	Consumer products tested are relevant (electric appliances, toys, office supplies, household items), but uncertain of parallel between Chinese products and American products; not all products may be equally applicable
	Metric 5:	Sample Size and Variability	High	15 samples investigated for TBBPA across range of consumer products
	Metric 6:	Temporality	High	Most of the samples were collected from 2017 products, but 11 samples were from products that "have been in use for several years"
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Low	No tabulated raw or summary stats data; range of TBBPA detections reported in text for all products sampled; mean concentration given for toys and electric appliances; product concentration given for power plug and wall switch samples
	Metric 8:	Quality Assurance	Medium	QA/QC measures discussed, including sources of reagents and signal to noise ratio threshold; surrogate recoveries 78 to 112%
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Medium	Variability discussed in the consumer products tested, but limited discussion of uncertainties or gaps
Overall Quality Determination			Medium	

Study Citation:		Sharkey, M., Abdallah, M. A., Drage, D. S., Harrad, S., Berresheim, H. (2018). Portable X-ray fluorescence for the detection of POP-BFRs in waste plastics. Science of the Total Environment 639:49-57.		
HERO ID:		5550353		
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling Methodology and Conditions	Medium	Sampling methodology discussed and reasonable but not cited/sourced from a standard
	Metric 2:	Analytical Methodology	Low	Analytical methodology discussed, GC–MS and LC–MS/MS; LOQ and LOD referenced but values not reported
	Metric 3:	Biomarker Selection	N/A	Biomarker not used
Domain 2: Representative	Metric 4:	Testing Scenario	Medium	Chemicals in waste plastics are reasonable exposure scenario, but plastics samples were collected in Ireland so relevance to US products may not be exact
	Metric 5:	Sample Size and Variability	Low	Samples sorted into categories, in total 555 items tested, but no mention of replicate tests
	Metric 6:	Temporality	Low	Study published in 2018 but the year of sample collection not identified.
Domain 3: Accessibility/Clarity	Metric 7:	Reporting of Results	Critically Deficient	Concentrations of TBBPA not reported. Only mention of TBBPA-specific concentrations is a note that fifteen samples with concentrations > 1000 mg/kg were identified as false positives
	Metric 8:	Quality Assurance	Medium	Concentrations from samples compared to previous studies along with QA/QC measures including blank samples and repeated analysis of reference materials
Domain 4: Variability and Uncertainty	Metric 9:	Variability and Uncertainty	High	Variability addressed in variety of waste products and limitations discussed in detail, though mostly related to the method rather than the samples or concentrations
Overall Quality Determination		Uninformative		

Study Citation:		U.S. EPA, U.,S.G.S. and National Water Quality Monitoring Council (2022). 4,4-(1-Methylethylidene)bis[2, 6-dibromophenol] (TBBPA) (CAS RN: 79-94-7): WQP Output (NWIS, STEWARDS {\&} STORET), Site data {\&} sample results (physical/chemical metadata).		
HERO ID:		10709360		
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling Methodology	Medium	Sampling methodology information is provided in columns AF to AJ, including the sampling method code and the equipment used. No information was provided on transportation or storage conditions for any sample. Note that for a large portion of the samples the sampling methodology was reported as "UNKNOWN".
	Metric 2:	Analytical Methodology	High	Description of the methods reported in column BQ and detection limit in column BY. A detection limit was not provided for all samples. While there is heterogeneity in the information provided, the confidence rating of high is based on the samples with the most complete data.
Domain 2: Representative	Metric 3:	Geographic Area	High	Column X reports the location identifier code. All samples are from the U.S. The station.xlsx file included as part of the HERO reference provides detailed information on the sites sampled. The information of each code can be found at https://waterdata.usgs.gov/nwis/si
	Metric 4:	Temporal	High	Data was collected from 1988 to 2022. The date is reported in column G. Three datapoints are from 1899 but they are likely a typo.
	Metric 5:	Exposure Scenario	Medium	Media are reported in column E and F; location and time are also reported. The station.xlsx file included as part of the HERO reference provides, for some samples, more detailed information on the sites sampled, such as sample depth. There is no information provided on sources of chemicals.
Domain 3: Accessibility/Clarity	Metric 6:	Availability of Database and Supporting Documents	High	The database is widely accepted, and a user guide is available which describes all of the data fields.
	Metric 7:	Reporting Results	Medium	The database does not report summary of statistics, only point values. While the data are well organized, since the data originates from numerous different entities (states) and monitoring programs, some data may be difficult to interpret due to the lack of populated data fields or discrepancies between columns.
Domain 4: Variability and Uncertainty	Metric 8:	Variability and Uncertainty	Medium	Uncertainty is characterized by the inclusion of data qualifier column AR; however, it was not expected for all rows to have a data qualifier code (most do not). Column AS reports the results status identifier that indicates the acceptability of the result with respect to QA/QC criteria.
Overall Quality Determination			High	

Study Citation:		Toxicology Excellence for Risk Assessment (TERA) (2016). Flame retardant exposure assessment.		
HERO ID:		5155521		
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	Methodology outlined and assumptions provided.
Domain 2: Representative	Metric 2:	Exposure Scenario	High	The data closely represent exposure scenarios of interest.
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	High	References are available for all reported data, inputs, and defaults; and are publicly available and from peer reviewed sources.
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	High	Uncertainties discussed for various exposure factors and calculations.
Overall Quality Determination			High	

Study Citation:		Danish EPA, (2012). Survey No. 117: Exposure of pregnant consumers to suspected endocrine disruptors.		
HERO ID:		10622425		
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment reports the methodology to assess concentrations in selected consumer products and the methods to evaluate the exposure.
Domain 2: Representative	Metric 2:	Exposure Scenario	High	This health assessment evaluates the exposure of pregnant women to a selected chemicals by the use of consumer products.
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	High	References are available for all reported data, inputs, and defaults.
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	Medium	Variability of concentrations is reported for selected consumer products, but the results do not report statistical variability. Some limitations are reported in the conclusion section.
Overall Quality Determination			High	

Study Citation:		Takigami, H., Suzuki, G., Hirai, Y., Sakai, S. (2009). Brominated flame retardants and other polyhalogenated compounds in indoor air and dust from two houses in Japan. Chemosphere 76(2):270-277.		
HERO ID:		198241		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
Metric 1:		Mathematical Equations	Low	Equation is not referenced, but is based on a scientifically sound approach.
Metric 2:		Model Evaluation	Low	No evaluation was mentioned, but the method is accepted among the scientific community.
Domain 2: Representative				
Metric 3:		Exposure Scenario	Low	Sampling was conducted in 2006 (15 years ago)
Domain 3: Accessibility/Clarity				
Metric 4:		Model and Model Documentation Availability	Low	No model documentation.
Metric 5:		Model Inputs and Defaults	Medium	All inputs are provided and could be found throughout the paper.
Domain 4: Variability and Uncertainty				
Metric 6:		Variability and Uncertainty	Medium	Limited discussion; does include some discussion on p-chem properties and difference among different homes
Overall Quality Determination			Low	

Study Citation:		de Winter-Sorkina, R., Bakker, M. I., van Donkersgoed, G., van Klaveren, J. D. (2003). Dietary intake of brominated flame retardants by the Dutch population.		
HERO ID:		787641		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	Low	The methods for determining dietary intake of TBBPA are described generally but no equations are provided.
	Metric 2:	Model Evaluation	Low	The mean dietary intake of sum of PBDEs is compared to other studies but no comparison of TBBPA specific data.
Domain 2: Representative	Metric 3:	Exposure Scenario	Low	Exposure to TBBPA via diet is a reasonable pathway, but the data are specific to Dutch diets and foods from >15 years ago.
	Metric 4:	Model and Model Documentation Availability	Low	The methods for calculation and most data are provided, but the equation or model used is not explicitly presented.
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	Medium	Inputs appear to be described and provided with sources or justifications, including body weight, concentration in food item, food intake rates. Without equations, cannot confirm completeness.
	Metric 6:	Variability and Uncertainty	Low	Calculated mean intakes under two LOD treatments (1/2 LOD or 0) provided for TBBPA overall and for some food categories (all cheese, eel, herring, mussels). Authors provide discussion on the uncertainties and assert that these data are considered 'rough estimates'.
Overall Quality Determination		Low		

Study Citation:		Harrad, S., Goosey, E., Desborough, J., Abdallah, M. A. E., Roosens, L., Covaci, A. (2010). Dust from U.K. primary school classrooms and daycare centers: The significance of dust as a pathway of exposure of young U.K. children to brominated flame retardants and polychlorinated biphenyls. Environmental Science & Technology 44(11):4198-4202.		
HERO ID:		1076646		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	Low	Equation for dust exposure not provided, but it can likely be assumed based on the inputs, outputs, and supporting citations.
	Metric 2:	Model Evaluation	Low	Assumption that the model was evaluated through peer review; exposure outputs briefly compared to guidelines and previous estimates.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Study is from UK and greater than 10 years old, so doses may not reflect current conditions in US. Otherwise, exposure to dust in schools and daycares is a reasonable scenario.
Domain 3: Accessibility/Clarity	Metric 4:	Model and Model Documentation Availability	Low	Inputs and outputs are provided, but equations are not.
	Metric 5:	Model Inputs and Defaults	Medium	The inputs are all clearly identified and cited, but the thoroughness cannot be validated without the exposure equation used.
Domain 4: Variability and Uncertainty	Metric 6:	Variability and Uncertainty	Medium	Variability exhibited in exposure scenarios (low, typical, and high end) and comparison of child to adult exposures in classrooms vs offices. Some discussions of uncertainties, particularly around the assumptions related to inputs and how they may influence outputs (e.g. body weight of children).
Overall Quality Determination		Low		

Study Citation:		Abdallah, M. A., Harrad, S., Covaci, A. (2008). Hexabromocyclododecanes and tetrabromobisphenol-A in indoor air and dust in Birmingham, U.K: Implications for human exposure. Environmental Science & Technology 42(18):6855-6861.		
HERO ID:		1079114		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	Low	Exposure calculation methods and assumptions described, but no equations provided.
	Metric 2:	Model Evaluation	Medium	Inhalation and dust ingestion doses compared to dietary intake from the Dutch population; evaluation may not be representative of the model at hand.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Exposure to TBBPA via inhalation and dust ingestion in different microenvironments is representative of a current scenario, but the input data are from 2008 and based on UK rather than US data.
	Metric 4:	Model and Model Documentation Availability	Low	Inputs and outputs are described but no equation.
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	Medium	All inputs appear to be provided with citations or explanations as needed, but without the equation, the completeness cannot be fully validated.
	Metric 6:	Variability and Uncertainty	Medium	Variability is exhibited in the summary statistics provided (5th and 95th percentiles, average, median) for adults and toddlers. Additional variability is exhibited in mean and high end dust intake scenarios. There is some discussion on the uncertainties of the estimates, particularly around assumptions of activity patterns and absorption fraction.
Overall Quality Determination		Low		

Study Citation:		Zhou, X., Guo, J., Lin, K., Huang, K., Deng, J. (2013). Leaching characteristics of heavy metals and brominated flame retardants from waste printed circuit boards. Journal of Hazardous Materials 246-247:96-102.		
HERO ID:		1789485		
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	Medium	Equation provided for estimating potential maximum leaching concentration related to concentration at a given time and rate coefficient. No citation but appears scientifically sound.
	Metric 2:	Model Evaluation	Medium	Cmax values compared to other studies.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	The model represents a scenario of interest, but the inputs reflect data specific to Southeast China in 2013.
	Metric 4:	Model and Model Documentation Availability	High	Model equations, inputs, and outputs are provided.
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	Medium	All variables of the model are tabulated and have some descriptions; no citations as they all came from this study.
	Metric 6:	Variability and Uncertainty	Low	Goodness of fit described for calculated values of Cmax in relation to k; no discussion of the limitations or uncertainties in the estimates.
Overall Quality Determination		Medium		

Study Citation:		Ni, H. G., Zeng, H. (2013). HBCD and TBBPA in particulate phase of indoor air in Shenzhen, China. Science of the Total Environment 458-460:15-19.		
HERO ID:		1927552		
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	Medium	Equations provided for inhalation and ingestion exposure; no citations provided, but methods appear sound and generally accepted
	Metric 2:	Model Evaluation	Medium	Exposure estimates compared to data from similar studies and agreements and discrepancies are discussed.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Measured concentrations used in exposure estimates are from offices in China and are >5 years old, limiting their relevance to the conditions of exposure in current US offices.
Domain 3: Accessibility/Clarity	Metric 4:	Model and Model Documentation Availability	High	Methods can be followed with documentation provided.
	Metric 5:	Model Inputs and Defaults	High	Inputs to equations are identified, described, and cited when values are provided.
Domain 4: Variability and Uncertainty	Metric 6:	Variability and Uncertainty	High	Variability is exhibited in the particle size and concentration statistic (median, minimum, maximum, mean); evaluation of uncertainties conducted through a Monte Carlo simulation of exposure estimates.
Overall Quality Determination			High	

Study Citation:		Geens, T., Roosens, L., Neels, H., Covaci, A. (2009). Assessment of human exposure to Bisphenol-A, Triclosan and Tetrabromobisphenol-A through indoor dust intake in Belgium. Chemosphere 76(6):755-760.		
HERO ID:		2095186		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	Medium	No equation provided for exposure calculations, but the inputs and parameters are described and the equation can be inferred to be level of contaminant in dust multiplied by assumed dust intake.
	Metric 2:	Model Evaluation	Medium	Assumption that model used is of generally acceptable calculations but is not explicit. Estimates are compared to estimates to other routes and studies
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Exposure to indoor dust is a scenario of interest, but the data are specific to homes and offices in Flanders, Belgium from 2008
	Metric 4:	Model and Model Documentation Availability	Low	Equation not provided
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	Low	Input parameters are described and cited but cannot validate completeness without the equation
	Metric 6:	Variability and Uncertainty	Low	Variability in the intakes characterized by median and high exposures based on dust intake rates for adults and toddlers; uncertainties in exposure estimates only discussed in relation to the discussion of the inputs (concentrations)
Overall Quality Determination		Low		

Study Citation:		Fromme, H., Hilger, B., Kopp, E., Miserok, M., Völkel, W. (2014). Polybrominated diphenyl ethers (PBDEs), hexabromocyclododecane (HBCD) and "novel" brominated flame retardants in house dust in Germany. Environment International 64:61-68.		
HERO ID:		2343719		
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	Medium	Daily intake equation not provided, but the inputs and theory behind estimating dust ingestion exposures are described and appear sound.
	Metric 2:	Model Evaluation	Low	Narrative evaluation of the results, no direct evaluation of the model (equation not provided)
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Concentrations in dust based on samples in residences near Munich and southern Germany; likely similar to US, data from 2014
	Metric 4:	Model and Model Documentation Availability	Low	Intake equation not provided
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	Medium	Equation not provided, so completeness of inputs cannot be assessed; the inputs that are provided, however, are described in detail with citations or justifications for assumptions.
	Metric 6:	Variability and Uncertainty	Medium	Variability in intakes characterized through average and high intakes with a discussion related to the adult and toddler behaviors and assumptions; results compared to other studies to discuss and address uncertainties
Overall Quality Determination			Medium	

Study Citation:		Wu, Y., Li, Y., Kang, D., Wang, J., Zhang, Y., Du, D., Pan, B., Lin, Z., Huang, C., Dong, Q. (2016). Tetrabromobisphenol A and heavy metal exposure via dust ingestion in an e-waste recycling region in Southeast China. Science of the Total Environment 541:356-364.		
HERO ID:		3007772		
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	Medium	Equation 3 for TBBPA was referenced from peer reviewed sources.
	Metric 2:	Model Evaluation	Low	Equation 3 for TBBPA was referenced from peer reviewed sources and published in a peer reviewed article; present paper included comparison with other sources - evaluation was conducted by author
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	exposure sampling conducted in 2012 (between 5-15 years ago)
	Metric 4:	Model and Model Documentation Availability	Low	Studies referenced for equation 3 are not all free to the public.
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	High	All inputs are defined, values are provided, and referenced.
	Metric 6:	Variability and Uncertainty	High	some discussion include on variability and uncertainty; included spatial distribution pattern
Overall Quality Determination		Medium		

Study Citation: Nakao, T., Akiyama, E.,ma, Kakutani, H., Mizuno, A., Aozasa, O., Akai, Y., Ohta, S. (2015). Levels of tetrabromobisphenol A, tribromobisphenol A, dibromobisphenol A, monobromobisphenol A, and bisphenol A in Japanese breast milk. Chemical Research in Toxicology 28(4):722-728.

HERO ID: 3350553

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Mathematical Equations	Critically Deficient	The model or intake equation was not provided within this document.
	Metric 2: Model Evaluation	Critically Deficient	As the model or intake equation is not included, it cannot be evaluated.
Domain 2: Representative	Metric 3: Exposure Scenario	Medium	This is a relatively recent study, though based on Japanese data.
	Metric 4: Model and Model Documentation Availability	N/A	The model or intake equation is not provided in this document.
Domain 3: Accessibility/Clarity	Metric 5: Model Inputs and Defaults	Low	Some inputs and defaults are provided, but as the intake equation is not given, their completeness cannot be evaluated.
	Metric 6: Variability and Uncertainty	Low	There is no specific discussion of variability, uncertainty, or limitations in regards to the modeled intakes.
Domain 4: Variability and Uncertainty			

Overall Quality Determination

Uninformative

Study Citation:		Aznar-Alemany, Ò., Trabalón, L., Jacobs, S., Barbosa, V. L., Tejedor, M. F., Granby, K., Kwadijk, C., Cunha, S. C., Ferrari, F., Vandermeersch, G., Sioen, I., Verbeke, W., Vilavert, L., Domingo, J. L., Eljarrat, E., Barceló, D. (2016). Occurrence of halogenated flame retardants in commercial seafood species available in European markets. Food and Chemical Toxicology 104:35-47.		
HERO ID:		3454553		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Mathematical Equations	High	Probabilistic exposure assessment methods were used (@Risk software). This is a known software that is widely accepted.
	Metric 2:	Model Evaluation	High	Model and approach have undergone evaluation; references are provided.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Medium	Sampling conducted in 2014-2015; between 5-15 years ago.
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	Low	Must pay for @Risk software.
	Metric 5:	Model Inputs and Defaults	High	Inputs to equations were defined but values are less straight forward as exposure estimates used probabilistic modeling and Monte Carlo simulations.
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	High	Discussion included on variability and uncertainty.
Overall Quality Determination			High	

Study Citation:		Gallistl, C., Lok, B., Schlien, A., Vetter, W. (2017). Polyhalogenated compounds (chlorinated paraffins, novel and classic flame retardants, POPs) in dishcloths after their regular use in households. Science of the Total Environment 595(1):303-314.		
HERO ID:		3828894		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	Equation for daily skin uptake is shown in Supplemental Information, p. 21, with brief description. Study cites Liu et al 2017 as reference.
	Metric 2:	Model Evaluation	Medium	Targeted/limited evaluation of model - comparisons with other studies of estimated daily dermal absorption are shown in Table 4 (for sum of "other BFRs")
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Study and calculation reference are both from 2017 (~5 yrs old). German study of reusable dishcloths; may not be representative of US dishwashing practices.
	Metric 4:	Model and Model Documentation Availability	High	Model and documentation are provided in Supplemental information and companion reference (Liu et al 2017).
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	High	Model inputs and defaults are presented in Table 3 and SI (p. 21).
	Metric 6:	Variability and Uncertainty	Medium	Limited characterization of variability and limited discussion of uncertainty, limitations and data gaps. (estimated uptakes are based on low, medium and high concentrations; some discussion of exposure duration assumption).
Overall Quality Determination		High		

Study Citation:		Besis, A., Christia, C., Poma, G., Covaci, A., Samara, C. (2017). Legacy and novel brominated flame retardants in interior car dust~~~Implications for human exposure. Environmental Pollution 230:871-881.		
HERO ID:		3860936		
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	EPA equations for dermal and ingestion average daily intake (dose) ADD
	Metric 2:	Model Evaluation	Medium	The model itself has been evaluated extensively and published by EPA, but the intake estimates resulting from the model are only compared for select chemicals (TBBPA not included) to other published studies
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Exposure to dust in cars is a reasonable scenario, but the make/model of the cars may vary across countries and influence the relevance of the data presented
	Metric 4:	Model and Model Documentation Availability	High	Dose calculations can be followed without need for user guide; EPA equations for ADD are free and accessible, though not all papers used as references are
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	High	Inputs for ADD given with citations, many are EPA
	Metric 6:	Variability and Uncertainty	High	Variability and uncertainty in inputs discussed (i.e. time spent in car may have significant influence over exposure estimate), limitations addressed in availability of data to apply the model
Overall Quality Determination		High		

Study Citation:		Tay, J. H., Sellström, U., Papadopoulou, E., Padilla-Sánchez, J. A., Haug, L. S., de Wit, C. A. (2017). Human exposure to legacy and emerging halogenated flame retardants via inhalation and dust ingestion in a Norwegian cohort. Environmental Science & Technology 51(14):8176-8184.		
HERO ID:		3861571		
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	Exposure equations from EPA source
	Metric 2:	Model Evaluation	High	Model based on EPA Exposure Factors Handbook - indicates the equation has undergone evaluation and is accepted among the scientific community.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Monitoring data is from 2013-2014; between 5-15 years ago
Domain 3: Accessibility/Clarity	Metric 4:	Model and Model Documentation Availability	High	Exposure Factors Handbook is publicly available for free
	Metric 5:	Model Inputs and Defaults	High	Inputs are defined and values from Exposure Factors Handbook are cited.
Domain 4: Variability and Uncertainty	Metric 6:	Variability and Uncertainty	High	Variability and uncertainty discussed
Overall Quality Determination			High	

Study Citation:		Shi, Z., Zhang, L., Zhao, Y., Sun, Z., Zhou, X., Li, J., Wu, Y. (2017). Dietary exposure assessment of Chinese population to tetrabromobisphenol-A, hexabromocyclododecane and decabrominated diphenyl ether: Results of the 5th Chinese total diet study. Environmental Pollution 229:539-547.		
HERO ID:		3975096		
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	Low	Estimated daily intake calculation is explained in text. No reference is included but is a simple calculation that is based on a scientifically sound approach. Text is descriptive enough to generate equation Values were compared to other peer reviewed studies; evaluation was according to the author
	Metric 2:	Model Evaluation	Low	
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	exposure was based on Chinese Total Diet Study in 2011; 5-15 years ago
Domain 3: Accessibility/Clarity	Metric 4:	Model and Model Documentation Availability	N/A	Dietary intake equation is not referenced; no additional documentation is applicable
	Metric 5:	Model Inputs and Defaults	Medium	limited description of inputs to daily intake provided
Domain 4: Variability and Uncertainty	Metric 6:	Variability and Uncertainty	Medium	discussion included on variability and uncertainty; mentioned large difference in food consumption between different regions
Overall Quality Determination			Low	

Study Citation:		Petito Boyce, C., Sax, S., G Dodge, D., C Pollock, M., Goodman, J. (2009). Human exposure to decabromodiphenyl ether, tetrabromobisphenol A, and decabromodiphenyl ethane in indoor dust. Journal of Environmental Protection Science 3:75-96.		
HERO ID:		4159528		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	Medium	Equation for ADD provided, summing the ingestion and dermal exposures. The equation is based on US EPA's risk assessment guidance.
	Metric 2:	Model Evaluation	High	Equation based on EPA methods and similar modeled data from other studies presented for comparison
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Model inputs likely reflect relevant conditions of indoor dust exposure via ingestion and dermal contact, based in North America but concentration data (Dodge et al) are from 2009
	Metric 4:	Model and Model Documentation Availability	High	Model equations and inputs are sufficient
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	High	Inputs are described in detail with citations, assumptions, or calculations presented as appropriate for inclusion in the model
	Metric 6:	Variability and Uncertainty	Medium	Limitations and data gaps identified for each input and final calculations; variability characterized in regions, adult vs child, and mean and 95th percentile calculations.
Overall Quality Determination		High		

Study Citation:		Tasaki, T., Takasuga, T., Osako, M., Sakai, S. (2004). Substance flow analysis of brominated flame retardants and related compounds in waste TV sets in Japan. Waste Management 24(6):571-580.		
HERO ID:		4160103		
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	Medium	Methods in paper based on previously published peer reviewed sources
	Metric 2:	Model Evaluation	Low	Model based on many previously published peer reviewed sources and includes well known methods (Weibull distribution); method was validated by author
Domain 2: Representative	Metric 3:	Exposure Scenario	Low	data was based on Masuko et al 2000 paper (TV sets manufactured between 1984-1998); > 15 years ago
	Metric 4:	Model and Model Documentation Availability	Low	equation in the development of the time-series SFA are not all free to the public
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	High	All inputs are described
	Metric 6:	Variability and Uncertainty	Medium	some discussion included on variability and uncertainty
Overall Quality Determination			Low	

Study Citation:		Wang, J., Wang, Y., Shi, Z., Zhou, X., Sun, Z. (2017). Legacy and novel brominated flame retardants in indoor dust from Beijing, China: Occurrence, human exposure assessment and evidence for PBDEs replacement. Science of the Total Environment 618:48-59.		
HERO ID:		4168013		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	Medium	Exposure via dust ingestion equation not provided, but methods are briefly described with the inputs and appear sound.
	Metric 2:	Model Evaluation	Low	No indication of evaluation of exposure metrics, but the concentrations used in the calculations were compared to other studies.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Adult and toddler exposure to dust in offices and homes represents current scenario (2018) but data are based on Beijing population.
	Metric 4:	Model and Model Documentation Availability	Low	Inputs and outputs appear to be presented, but without the explicit equation the model documentation requires some guesswork.
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	Medium	Inputs to daily intake estimates are provided with citations, but there is no equation to confirm that all inputs are provided.
	Metric 6:	Variability and Uncertainty	Medium	Variability characterized in the population (adults/toddlers, office/home) across three concentration scenarios (low, medium, high). Some discussion of limitations, such as small sample size, and need for future work.
Overall Quality Determination		Low		

Study Citation:		Larsson, K., de Wit, C. A., Sellström, U., Sahlström, L., Lindh, C. H., Berglund, M. (2018). Brominated flame retardants and organophosphate esters in preschool dust and children's hand wipes. Environmental Science & Technology 52(8):4878-4888.		
HERO ID:		4292136		
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	Dose equations were referenced and are from EPA sources.
	Metric 2:	Model Evaluation	High	Dose equations were referenced and are from EPA sources, it is assumed they have undergone evaluation.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Sampling was conducted in 2015.
Domain 3: Accessibility/Clarity	Metric 4:	Model and Model Documentation Availability	Low	While references on equations were free and publicly available, the concentrations were found using STATA, a statistical software that is not free/publicly available.
	Metric 5:	Model Inputs and Defaults	High	Model inputs are described and values are provided and referenced.
Domain 4: Variability and Uncertainty	Metric 6:	Variability and Uncertainty	High	Discussion included on variability and uncertainty.
Overall Quality Determination			High	

Study Citation:		Lu, J. F., He, M. J., Yang, Z. H., Wei, S. Q. (2018). Occurrence of tetrabromobisphenol a (TBBPA) and hexabromocyclododecane (HBCD) in soil and road dust in Chongqing, western China, with emphasis on diastereoisomer profiles, particle size distribution, and human exposure. Environmental Pollution 242(Pt A):219-228.		
HERO ID:		5041213		
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	Exposure calculations are from EPA sources
	Metric 2:	Model Evaluation	High	Exposure calculations are from EPA sources - assumed to have undergone evaluation
Domain 2: Representative	Metric 3:	Exposure Scenario	High	Monitoring conducted in July 2016, < 5 years ago
Domain 3: Accessibility/Clarity	Metric 4:	Model and Model Documentation Availability	High	EPA sources - available to the public for free
	Metric 5:	Model Inputs and Defaults	High	Model inputs are defined and referenced (more detail in supplemental information)
Domain 4: Variability and Uncertainty	Metric 6:	Variability and Uncertainty	Medium	some discussion included on variability and uncertainty
Overall Quality Determination			High	

Study Citation:		Tay, J. H., Sellström, U., Papadopoulou, E., Padilla-Sánchez, J. A., Haug, L. S., de Wit, C. A. (2018). Assessment of dermal exposure to halogenated flame retardants: Comparison using direct measurements from hand wipes with an indirect estimation from settled dust concentrations. Environment International 115:285-294.		
HERO ID:		5349328		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	Equations for dermal exposure using hand wipe and via dust contact provided and described in detail. page no. 287
	Metric 2:	Model Evaluation	Medium	Concentrations used in the model compared to other studies; direct vs indirect outputs compared to each other; peer review.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Equations and most inputs are cited to EPA and relevant to exposure to TBBPA but concentrations are related to Norwegian population through cohort study 2013-2014
Domain 3: Accessibility/Clarity	Metric 4:	Model and Model Documentation Availability	High	Equations and data provided are sufficient
	Metric 5:	Model Inputs and Defaults	High	Inputs are described in detail and provided with citations, calculations, or justifications.
Domain 4: Variability and Uncertainty	Metric 6:	Variability and Uncertainty	High	5th and 95th percentiles and median daily exposure estimates provided for adults from both hand wipe and settled dust exposure; significant discussion related to uncertainties around absorption fraction and limits of dermal absorption when considering flux of TBBPA
Overall Quality Determination		High		

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.
	Metric 4:	Model and Model Documentation Availability	High	Equation provided to follow calculations of daily intakes.
Domain 3: Accessibility/Clarity	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.
	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:		Pawar, G., Abdallah, M. A.,e, De Sáa, E. V., Harrad, S. (2017). Dermal bioaccessibility of flame retardants from indoor dust and the influence of topically applied cosmetics. Journal of Exposure Science & Environmental Epidemiology 27(1):100-105.		
HERO ID:		5469614		
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	Low	Bioaccessibility and dose equation did not included references, but are considered acceptable based on scientifically sound approaches.
	Metric 2:	Model Evaluation	Low	Bioaccessibility and dose equation did not included references, but are considered acceptable based on scientifically sound approaches.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Publication is from 2016.
Domain 3: Accessibility/Clarity	Metric 4:	Model and Model Documentation Availability	Low	Model documentation is not available (equations are not referenced).
	Metric 5:	Model Inputs and Defaults	High	Key model inputs are identified, described, and referenced when applicable.
Domain 4: Variability and Uncertainty	Metric 6:	Variability and Uncertainty	Medium	Some discussion on variability and uncertainty.
Overall Quality Determination			Low	

Study Citation:		Martínez, M. Á., Castro, I., Rovira, J., Ares, S., Rodríguez, J. M., Cunha, S. C., Casal, S., Fernandes, J. O., Schuhmacher, M., Nadal, M. (2019). Early-life intake of major trace elements, bisphenol A, tetrabromobisphenol A and fatty acids: Comparing human milk and commercial infant formulas. Environmental Research 169:246-255.		
HERO ID:		5497323		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	Equation for daily intake via milk ingestion is provided and described; appears scientifically sound.
	Metric 2:	Model Evaluation	Low	Assumption of peer review by journal publication; narrative evaluation of model and its relevance.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Some inputs are more relevant than others (milk intake cited to US EPA 2011) but the concentrations represent breastmilk and infant formula in Spain; cannot validate relevance without known brand names.
	Metric 4:	Model and Model Documentation Availability	High	Inputs and equation are sufficient
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	Low	Concentrations are tabulated and the consumption rate of milk is cited to US EPA 2011 but the value is not provided.
	Metric 6:	Variability and Uncertainty	Low	Variability characterized in ages and formula v human but limited discussion on TBBPA.
Overall Quality Determination		Medium		

Study Citation:		Abdallah, M. A. E., Bressi, M., Oluseyi, T., Harrad, S. (2016). Hexabromocyclododecane and tetrabromobisphenol-A in indoor dust from France, Kazakhstan and Nigeria: Implications for human exposure. Emerging Contaminants 2(2):73-79.		
HERO ID:		5519202		
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	Medium	Equation referenced from peer reviewed source.
	Metric 2:	Model Evaluation	Low	Equation referenced from peer reviewed source and published in a peer reviewed journal; no more formal evaluation is mentioned
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Sampling conducted between 2008-2014; 5-15 years ago
	Metric 4:	Model and Model Documentation Availability	Low	Equation referenced is not free to the public.
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	High	Model inputs are defined and values cited.
	Metric 6:	Variability and Uncertainty	Medium	Variability and uncertainty discussed; mention of highly uncertain ingestion rates
Overall Quality Determination		Medium		

Study Citation:		Gao, C. J., Xia, L. L., Wu, C. C., Wong, C. S., Guo, Y. (2019). The effects of prosperity indices and land use indicators of an urban conurbation on the occurrence of hexabromocyclododecanes and tetrabromobisphenol A in surface soil in South China. Environmental Pollution 252(Pt B):1810-1818.		
HERO ID:		5680040		
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	Equations provided for EDI via ingestion, inhalation, and dermal exposure; all cited to EPA sources.
	Metric 2:	Model Evaluation	High	Models used for each route cited to EPA, widely accepted and evaluated.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Exposure estimated based on recent soil concentrations (2019) but from Chinese soil; slightly older exposure factors (2007-2012).
Domain 3: Accessibility/Clarity	Metric 4:	Model and Model Documentation Availability	High	Model equations and inputs are provided to follow methodology.
	Metric 5:	Model Inputs and Defaults	High	Model inputs are tabulated in SI with citations.
Domain 4: Variability and Uncertainty	Metric 6:	Variability and Uncertainty	High	Exposure estimated through three pathways for 7 locations and three age groups. Some discussion of uncertainties related to soil samples, which influences exposure estimates.
Overall Quality Determination			High	

4,4'-(1-Methylethylidene)bis[2,6-dibromophenol] (TBBPA) Glossary of Select Terms for Data Evaluation Tables

Table 245: Glossary of Select Terms for Data Evaluation

Term	Definition
7Q10	The lowest 7-day average flow that occurs (on average) once every 10 years
30Q5	30 consecutive days of lowest flow over a 5-year period
ADD	Average daily dose
ADR	Acute dose rate
ADR _{POT}	Potential acute dose rate
BAF	Bioaccumulation factor
BCF	Bioconcentration factor
BSAF	Biota-sediment accumulation factor
CADD	Chronic average daily dose
CEM	Consumer Exposure Model
COU	Condition of use
dw	Dry weight
ECHO	EPA's Enforcement and Compliance History Online database
EPA	Environmental Protection Agency (U.S.)
IIOAC	Integrated indoor-outdoor air calculator
KOC	Organic carbon/water partition coefficient
Kp	Dermal permeability coefficient
MOE	Margin of exposure
NAICS	North American Industry Classification System
OES	Occupational exposure scenario
PESS	Potentially exposed or susceptible subpopulation
RCRA	Resource Conservation and Recovery Act
TBBPA	4,4'-(1-Methylethylidene)bis[2,6-dibromophenol] or Tetrabromo-bisphenol A
TMF	Trophic magnification factor
TRI	Toxics Release Inventory
TSCA	Toxic Substances Control Act
ww	Wet weight