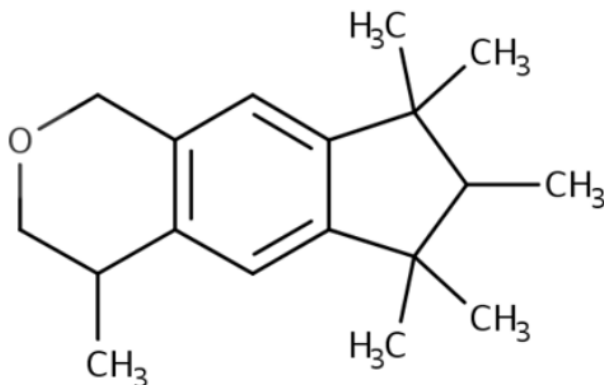

**Draft Data Quality Evaluation Information for
General Population, Consumer, and Environmental Exposure for
1,3,4,6,7,8-Hexahydro-4,6,6,7,8,8-hexaethylcyclopenta[γ]-2-benzopyran (HHCB)**

Systematic Review Support Document for the Draft Risk Evaluation

CASRN: 1222-05-5



March 2026

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 Human Exposure Assessment for 1,3,4,6,7,8-Hexahydro-4,6,6,7,8,8-hexamethylcyclopenta[g]-2-benzopyran (HHCB)*, and the *Draft Environmental Exposure Assessment for 1,3,4,6,7,8-Hexahydro-4,6,6,7,8,8-hexamethylcyclopenta [g]-2-benzopyran (HHCB)*, 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 1,3,4,6,7,8-Hexahydro-4,6,6,7,8,8-hexamethylcyclopenta [g]-2-benzopyran (HHCB)*,

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 1,3,4,6,7,8-Hexahydro-4,6,6,7,8,8-hexamethylcyclopenta [g]-2-benzopyran (HHCB)*,

Table of Contents

HERO ID	Reference	Page
Monitoring		
118402	Peck, A. M., Hornbuckle, K. C. (2006). Synthetic musk fragrances in urban and rural air of Iowa and the Great Lakes. <i>Atmospheric Environment</i> 40(32):6101-6111.	17
386594	Sumner, N. R., Guitart, C., Fuentes, G., Readman, J. W. (2010). Inputs and distributions of synthetic musk fragrances in an estuarine and coastal environment; a case study. <i>Environmental Pollution</i> 158(1):215-222.	18
509549	Peck, A. M., Linebaugh, E. K., Hornbuckle, K. C. (2006). Synthetic musk fragrances in Lake Erie and Lake Ontario sediment cores. <i>Environmental Science & Technology</i> 40(18):5629-5635.	19
510316	Peters, R. J. B., Beeltje, H., van Delft, R. J. (2008). Xeno-estrogenic compounds in precipitation. <i>Journal of Environmental Monitoring</i> 10(6):760-769.	20
679135	Aguayo, S., Munoz, M. J., de La, T. A., Roset, J., de La, P. E., Carballo, M. (2004). Identification of organic compounds and ecotoxicological assessment of sewage treatment plants (STP) effluents. <i>Science of the Total Environment</i> 328(1-3):69-81.	21
697423	Bidwell, J., Becker, C., Hensley, S., Stark, R., Meyer, M. (2010). Occurrence of organic wastewater and other contaminants in cave streams in northeastern Oklahoma and northwestern Arkansas. <i>Archives of Environmental Contamination and Toxicology</i> 58(2):286-298.	22
697481	Chen, X., Pauly, U., Rehfus, S., Bester, K. (2009). Personal care compounds in a reed bed sludge treatment system. <i>Chemosphere</i> 76(8):1094-1101.	23
791113	Paxeus, N. (1996). Organic pollutants in the effluents of large wastewater treatment plants in Sweden. <i>Water Research</i> 30(5):1115-1122.	24
1249442	Schlumpf, M., Kypke, K., Wittassek, M., Angerer, J., Mascher, H., Mascher, D., Vökt, C., Birchler, M., Lichtensteiger, W. (2010). Exposure patterns of UV filters, fragrances, parabens, phthalates, organochlor pesticides, PBDEs, and PCBs in human milk: correlation of UV filters with use of cosmetics. <i>Chemosphere</i> 81(10):1171-1183.	25
1249709	Reyes-Contreras, C., Matamoros, V., Ruiz, I., Soto, M., Bayona, J. M. (2011). Evaluation of PPCPs removal in a combined anaerobic digester-constructed wetland pilot plant treating urban wastewater. <i>Chemosphere</i> 84(9):1200-1207.	26
1467354	Moon, H. B., An, Y. R., Choi, S. G., Choi, M., Choi, H. G. (2012). Accumulation of PAHs and synthetic musk compound in minke whales (<i>Balanoptera acutorostrata</i>) and long-beaked common dolphins (<i>Delphinus capensis</i>) from Korean coastal waters. <i>Environmental Toxicology and Chemistry</i> 31(3):477-485.	27
1487274	Gatermann, R., Hellou, J., Huehnerfuss, H., Rimkus, G., Zitko, V. (1999). Polycyclic and nitro musks in the environment: A comparison between Canadian and European aquatic biota. <i>Chemosphere</i> 38(14):3431-3441.	28
1597705	Arukwe, A., Eggen, T., Moeder, M. (2012). Solid waste deposits as a significant source of contaminants of emerging concern to the aquatic and terrestrial environments - A developing country case study from Owerri, Nigeria. <i>Science of the Total Environment</i> 438(Elsevier):94-102.	29
1619118	Andresen, J. A., Muir, D., Ueno, D., Darling, C., Theobald, N., Bester, K. (2007). Emerging pollutants in the North Sea in comparison to Lake Ontario, Canada, data. <i>Environmental Toxicology and Chemistry</i> 26(6):1081-1089.	30
1794878	Teijon, G., Candela, L., Tamoh, K., Molina-Díaz, A., Fernández-Alba, A. R. (2010). Occurrence of emerging contaminants, priority substances (2008/105/CE) and heavy metals in treated wastewater and groundwater at Depurbaix facility (Barcelona, Spain). <i>Science of the Total Environment</i> 408(17):3584-3595.	31
1964555	Lv, Y., Yuan, T., Hu, J., Wang, W. (2010). Seasonal occurrence and behavior of synthetic musks (SMs) during wastewater treatment process in Shanghai, China. <i>Science of the Total Environment</i> 408(19):4170-4176.	32
1968396	Sang, W., Zhang, Y., Zhou, X., Ma, L., Sun, X. (2012). Occurrence and Distribution of Synthetic Musks in Surface Sediments of Liangtan River, West China. <i>Environmental Engineering Science</i> 29(1):19-25.	33

1970730	Upadhyay, N., Sun, Q., Allen, J. O., Westerhoff, P., Herckes, P. (2011). Synthetic musk emissions from wastewater aeration basins. <i>Water Research</i> 45(3):1071-1078.	34
2095404	Lu, Y.,an, Yuan, T.,ao, Yun, S., Wang, W., Kannan, K. (2011). Occurrence of synthetic musks in indoor dust from China and implications for human exposure. <i>Archives of Environmental Contamination and Toxicology</i> 60(1):182-189.	35
2157333	Reiner, J. L., Wong, C. M., Arcaro, K. F., Kannan, K. (2007). Synthetic musk fragrances in human milk from the United States. <i>Environmental Science & Technology</i> 41(11):3815-3820.	36
2158150	Schmid, P., Kohler, M., Gujer, E., Zennegg, M., Lanfranchi, M. (2007). Persistent organic pollutants, brominated flame retardants and synthetic musks in fish from remote alpine lakes in Switzerland. <i>Chemosphere</i> 67(9):S16-S21.	37
2162536	Fromme, H., Otto, T., Pilz, K., Neugebauer, F. (1999). Levels of synthetic musks; Bromocyclene and PCBs in eel (<i>Anguilla anguilla</i>) and PCBs in sediment samples from some waters of Berlin/Germany. <i>Chemosphere</i> 39(10):1723-1735.	38
2163577	Stevens, J. L., Northcott, G. L., Stern, G. A., Tomy, G. T., Jones, K. C. (2003). PAHs, PCBs, PCNs, organochlorine pesticides, synthetic musks, and polychlorinated n-alkanes in U.K. sewage sludge: Survey results and implications. <i>Environmental Science & Technology</i> 37(3):462-467.	39
2169077	Kallenborn, R., Gatermann, R., Nygard, T., Knutzen, J., Schlabach, M. (2001). Synthetic musks in Norwegian marine fish samples collected in the vicinity of densely populated areas. <i>Fresenius Environmental Bulletin</i> 10(11):832-842.	40
2177137	Moon, H., An, Y. R., Park, K. J., Choi, S. G., Moon, D., Choi, M., Choi, H. (2011). Occurrence and accumulation features of polycyclic aromatic hydrocarbons and synthetic musk compounds in finless porpoises (<i>Neophocaena phocaenoides</i>) from Korean coastal waters. <i>Marine Pollution Bulletin</i> 62(9):1963-1968.	41
2177626	Muller, S., Schmid, P., Schlatter, C. (1996). Occurrence of nitro and non-nitro benzenoid musk compounds in human adipose tissue. <i>Chemosphere</i> 33(1):17-28.	42
2183480	Schiavone, A., Kannan, K., Horii, Y., Focardi, S., Corsolini, S. (2009). Occurrence of brominated flame retardants, polycyclic musks, and chlorinated naphthalenes in seal blubber from Antarctica: Comparison to organochlorines. <i>Marine Pollution Bulletin</i> 58(9):1415-1419.	43
2184061	Shek, W. M., Murphy, M. B., Lam, J. C. W., Lam, P. K. S. (2008). Synthetic polycyclic musks in Hong Kong sewage sludge. <i>Chemosphere</i> 71(7):1241-1250.	44
2187423	Wan, Y., Wei, Q., Hu, J., Jin, X., Zhang, Z., Zhen, H., Liu, J. (2007). Levels, tissue distribution, and age-related accumulation of synthetic musk fragrances in Chinese sturgeon (<i>Acipenser sinensis</i>): Comparison to organochlorines. <i>Environmental Science & Technology</i> 41(2):424-430.	45
2188577	Xie, Z., Ebinghaus, R., Temme, C., Heemken, O., Ruck, W. (2007). Air-sea exchange fluxes of synthetic polycyclic musks in the north sea and the Arctic. <i>Environmental Science & Technology</i> 41(16):5654-5659.	46
2189240	Zehring, M., Herrmann, A. (2001). Analysis of polychlorinated biphenyls, pyrethroid insecticides and fragrances in human milk using a laminar cup liner in the GC injector. <i>European Food Research and Technology</i> 212(2):247-251.	47
2189417	Zhang, X., Xu, Q., Man, S., Zeng, X., Yu, Y., Pang, Y., Sheng, G., Fu, J. (2013). Tissue concentrations, bioaccumulation, and biomagnification of synthetic musks in freshwater fish from Taihu Lake, China. <i>Environmental Science and Pollution Research</i> 20(1):311-322.	48
2214896	Subedi, B., Du, B., Chambliss, C. K., Koschorreck, J.,an, Ruedel, H., Quack, M., Brooks, B. W., Usenko, S. (2012). Occurrence of Pharmaceuticals and Personal Care Products in German Fish Tissue: A National Study. <i>Environmental Science & Technology</i> 46(16):9047-9054.	49
2215665	Shin, H. M., Mckone, T. E., Nishioka, M. G., Fallin, M. D., Croen, L. A., Hertz-Picciotto, I., Newschaffer, C. J., Bennett, D. H. (2014). Determining source strength of semivolatile organic compounds using measured concentrations in indoor dust. <i>Indoor Air</i> 24(3):260-271.	50
2241683	Blanchard, O., Glorennec, P., Mercier, F., Bonvallot, N., Chevrier, C., Ramalho, O., Mandin, C., Le Bot, B. (2014). Semivolatile organic compounds in indoor air and settled dust in 30 French dwellings. <i>Environmental Science & Technology</i> 48(7):3959-3969.	51
2298081	Mercier, F., Gilles, E., Saramito, G., Glorennec, P., Le Bot, B. (2014). A multi-residue method for the simultaneous analysis in indoor dust of several classes of semi-volatile organic compounds by pressurized liquid extraction and gas chromatography/tandem mass spectrometry. <i>Journal of Chromatography A</i> 1336:101-111.	52

2541915	Villa, S., Vighi, M., Finizio, A. (2014). Theoretical and experimental evidences of medium range atmospheric transport processes of polycyclic musk fragrances. <i>Science of the Total Environment</i> 481(1):27-34.	53
2553805	Mu, L., Wen, J. P. (2013). Spatial distribution characteristics of polycyclic musks as a chemical marker in river water and sediment compared with other typical pollutants. <i>Water Science and Technology</i> 67(6):1173-1180.	54
2554823	Del Río, H., Suárez, J., Puertas, J., Ures, P. (2013). PPCPs wet weather mobilization in a combined sewer in NW Spain. <i>Science of the Total Environment</i> 449(Elsevier):189-198.	55
2562851	Kubwabo, C., Fan, X., Rasmussen, P. E., Wu, F. (2012). Determination of synthetic musk compounds in indoor house dust by gas chromatography-ion trap mass spectrometry. <i>Analytical and Bioanalytical Chemistry</i> 404(2):467-477.	56
2598189	Moldovan, Z., Chira, R., Alder, A. C. (2009). Environmental exposure of pharmaceuticals and musk fragrances in the Somes River before and after upgrading the municipal wastewater treatment plant Cluj-Napoca, Romania. <i>Environmental Science and Pollution Research</i> 16(1 p.46-54):46-54.	57
2629713	Ramirez, N., Maria Marce, R., Borrull, F. (2010). Development of a thermal desorption-gas chromatography-mass spectrometry method for determining personal care products in air. <i>Journal of Chromatography A</i> 1217(26):4430-4438.	58
2712965	Ramirez, N., Maria Marce, R., Borrull, F. (2011). Development of a stir bar sorptive extraction and thermal desorption-gas chromatography-mass spectrometry method for determining synthetic musks in water samples. <i>Journal of Chromatography A</i> 1218(1):156-161.	59
2918731	Dallongeville, A., Costet, N., Zmirou-Navier, D., Le Bot, B., Chevrier, C., Deguen, S., Annesi-Maesano, I., Blanchard, O. (2016). Volatile and semi-volatile organic compounds of respiratory health relevance in French dwellings. <i>Indoor Air</i> 26(3):426-438.	60
2919589	Calderón-Preciado, D., Matamoros, V., Bayona, J. M. (2011). Occurrence and potential crop uptake of emerging contaminants and related compounds in an agricultural irrigation network. <i>Science of the Total Environment</i> 412-413:14-19.	61
2919854	Luigi, V., Giuseppe, M., Claudio, R. (2015). Emerging and priority contaminants with endocrine active potentials in sediments and fish from the River Po (Italy). <i>Environmental Science and Pollution Research</i> 22(18):14050-14066.	62
2920040	Patiño, R., Vanlandeghem, M. M., Goodbred, S. L., Orsak, E., Jenkins, J. A., Echols, K., Rosen, M. R., Torres, L. (2015). Novel associations between contaminant body burdens and biomarkers of reproductive condition in male Common Carp along multiple gradients of contaminant exposure in Lake Mead National Recreation Area, USA. <i>General and Comparative Endocrinology</i> 219:112-124.	63
2927006	Zhang, X. L., Jing, Y., Ma, L., Zhou, J., Fang, X. M., Zhang, X. Y., Yu, Y. X. (2015). Occurrence and transport of synthetic musks in paired maternal blood, umbilical cord blood, and breast milk. <i>International Journal of Hygiene and Environmental Health</i> 218(1):99-106.	64
3021560	Cunha, S. C., Fernandes, J. O., Vallecillos, L., Cano-Sancho, G., Domingo, J. L., Pocurull, E., Borrull, F., Maulvault, A. L., Ferrari, F., Fernandez-Tejedor, M., Van den Heuvel, F., Kotterman, M. (2015). Co-occurrence of musk fragrances and UV-filters in seafood and macroalgae collected in European hotspots. <i>Environmental Research</i> 143(Pt B):65-71.	65
3055263	Reinstorf, F., Strauch, G., Schirmer, K., Gläser, H. R., Möder, M., Wennrich, R., Osenbrück, K., Schirmer, M. (2008). Mass fluxes and spatial trends of xenobiotics in the waters of the city of Halle, Germany. <i>Environmental Pollution</i> 152(2):452-460.	66
3071092	Ros, O., Izaguirre, J. K., Olivares, M., Bizarro, C., Ortiz-Zarragoitia, M., Cajaraville, M. P., Etxebarria, N., Prieto, A., Vallejo, A. (2015). Determination of endocrine disrupting compounds and their metabolites in fish bile. <i>Science of the Total Environment</i> 536:261-267.	67
3113340	Rüdel, H., Böhmer, W., Schröter-Kermani, C. (2006). Retrospective monitoring of synthetic musk compounds in aquatic biota from German rivers and coastal areas. <i>Journal of Environmental Monitoring</i> 8(8):812-823.	68
3155347	Lu, B., Feng, Y., Gao, P., Zhang, Z., Lin, N. (2015). Distribution and fate of synthetic musks in the Songhua River, Northeastern China: influence of environmental variables. <i>Environmental Science and Pollution Research</i> 22(12):9090-9099.	69
3229681	Raffy, G., Mercier, F., Blanchard, O., Derbez, M., Dassonville, C., Bonvallot, N., Glorennec, P., Le Bot, B. (2016). Semi-volatile organic compounds in the air and dust of 30 French schools: A pilot study. <i>Indoor Air</i> 27(1):114-127.	70
3230506	Mandin, C., Mercier, F., Rarnalho, O., Lucas, J. P., Gilles, E., Blanchard, O., Bonvallot, N., Glorennec, P., Le Bot, B. (2016). Semi-volatile organic compounds in the particulate phase in dwellings: A nationwide survey in France. <i>Atmospheric Environment</i> 136:82-94.	71
3230514	Laborie, S., Moreau-Guigon, E., Alliot, F., Desportes, A., Oziol, L., Chevreuil, M. (2016). A new analytical protocol for the determination of 62 endocrine-disrupting compounds in indoor air. <i>Talanta</i> 147:132-141.	72

3350497	Zhang, H., Bayen, S., Kelly, B. C. (2015). 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. <i>Talanta</i> 143:7-18.	73
3350924	Pintado-Herrera, M. G., Wang, C., Lu, J., Chang, Y. P., Chen, W., Li, X., Lara-Martín, P. A. (2016). Distribution, mass inventories, and ecological risk assessment of legacy and emerging contaminants in sediments from the Pearl River Estuary in China. <i>Journal of Hazardous Materials</i> 323(Special Issue Pt A):128-138.	74
3351112	Pintado-Herrera, M. G., González-Mazo, E., Lara-Martín, P. A. (2016). In-cell clean-up pressurized liquid extraction and gas chromatography-tandem mass spectrometry determination of hydrophobic persistent and emerging organic pollutants in coastal sediments. <i>Journal of Chromatography A</i> 1429:107-118.	75
3351209	Goodbred, S. L., Patino, R., Torres, L., Echols, K. R., Jenkins, J. A., Rosen, M. R., Orsak, E. (2015). Are endocrine and reproductive biomarkers altered in contaminant-exposed wild male Largemouth Bass (<i>Micropterus salmoides</i>) of Lake Mead, Nevada/Arizona, USA?. <i>General and Comparative Endocrinology</i> 219:125-135.	76
3359674	Fontal, M., van Drooge, B. L., Grimalt, J. O. (2016). A rapid method for the analysis of methyl dihydrojasmonate and galaxolide in indoor and outdoor air particulate matter. <i>Journal of Chromatography A</i> 1447:135-140.	77
3364193	Kingsbury, J. A., Delzer, G. C., Hopple, J. A. (2008). Anthropogenic organic compounds in source water of nine community water systems that withdraw from streams, 2002–05. <i>Scientific Investigations Report</i> 2008-5208 :68.	78
3457886	Ferrario, C., Finizio, A., Villa, S. (2017). Legacy and emerging contaminants in meltwater of three Alpine glaciers. <i>Science of the Total Environment</i> 574(Elsevier):350-357.	79
3464285	Wang, Q., Kelly, B. C. (2017). Occurrence and distribution of synthetic musks, triclosan and methyl triclosan in a tropical urban catchment: Influence of land-use proximity, rainfall and physicochemical properties. <i>Science of the Total Environment</i> 574:1439-1447.	80
3559503	Focazio, M. J., Kolpin, D. W., Barnes, K. K., Furlong, E. T., Meyer, M. T., Zaugg, S. D., Barber, L. B., Thurman, M. E. (2008). A national reconnaissance for pharmaceuticals and other organic wastewater contaminants in the United States–II) untreated drinking water sources. <i>Science of the Total Environment</i> 402(2-3):201-216.	81
3983453	Combi, T., Pintado-Herrera, M. G., Lara-Martin, P. A., Miserocchi, S., Langone, L., Guerra, R. (2016). Distribution and fate of legacy and emerging contaminants along the Adriatic Sea: A comparative study. <i>Environmental Pollution</i> 218:1055-1064.	82
3984528	Aguirre-Rubí, J. R., Luna-Acosta, A., Etxebarria, N., Soto, M., Espinoza, F., Ahrens, M. J., Marigómez, I. (2017). Chemical contamination assessment in mangrove-lined Caribbean coastal systems using the oyster <i>Crassostrea rhizophorae</i> as biomonitor species. <i>Environmental Science and Pollution Research</i> 25(14):13396-13415.	83
3984543	Gundersen, D. T., Zeug, S. C., Bringolf, R. B., Merz, J., Jackson, Z., Webb, M. A. H. (2017). Tissue Contaminant Burdens in San Francisco Estuary White Sturgeon (<i>Acipenser transmontanus</i>): Implications for Population Recovery. <i>Archives of Environmental Contamination and Toxicology</i> 73(2):334-347.	84
3985839	Necibi, M., Lanceleur, L., Mzoughi, N., Monperrus, M. (2016). Determination of Synthetic Musks in Surface Sediment from the Bizerte Lagoon by QuEChERS Extraction Followed by GC-MS. <i>Bulletin of Environmental Contamination and Toxicology</i> 97(5):659-669.	85
4143122	Blum, K. M., Andersson, P. L., Renman, G., Ahrens, L., Gros, M., Wiberg, K., Haglund, P. (2017). Non-target screening and prioritization of potentially persistent, bioaccumulating and toxic domestic wastewater contaminants and their removal in on-site and large-scale sewage treatment plants. <i>Science of the Total Environment</i> 575:265-275.	86
4161902	Guerra, P., Kleywegt, S., Payne, M., Svoboda, M. L., Lee, H. B., Reiner, E., Kolic, T., Metcalfe, C., Smyth, S. A. (2015). Occurrence and Fate of Trace Contaminants during Aerobic and Anaerobic Sludge Digestion and Dewatering. <i>Journal of Environmental Quality</i> 44(4):1193-1200.	87
4167987	Tavera Busso, I., Tames, F., Silva, J. A., Ramos, S., Homem, V., Ratola, N., Carreras, H. (2017). Biomonitoring levels and trends of PAHs and synthetic musks associated with land use in urban environments. <i>Science of the Total Environment</i> 618:93-100.	88
4172003	Lefebvre, C., Kimpe, L. E., Metcalfe, C. D., Trudeau, V. L., Blais, J. M. (2017). Bioconcentration of polycyclic musks in fathead minnows caged in a wastewater effluent plume. <i>Environmental Pollution</i> 231(Pt 2):1593-1600.	89
4181507	Elliott, S. M., Brigham, M. E., Lee, K. E., Banda, J. A., Choy, S. J., Gefell, D. J., Minarik, T. A., Moore, J. N., Jorgenson, Z. G. (2017). Contaminants of emerging concern in tributaries to the Laurentian Great Lakes: I. Patterns of occurrence. <i>PLoS ONE</i> 12(9):e0182868.	90

4181569	Zhang, X., Liang, G., Zeng, X., Zhou, J., Sheng, G., Fu, J. (2011). Levels of synthetic musk fragrances in human milk from three cities in the Yangtze River Delta in Eastern China. <i>Journal of Environmental Sciences</i> 23(6):983-990.	91
4181598	Sengupta, A., Lyons, J. M., Smith, D. J., Drewes, J. E., Snyder, S. A., Heil, A., Maruya, K. A. (2014). The occurrence and fate of chemicals of emerging concern in coastal urban rivers receiving discharge of treated municipal wastewater effluent. <i>Environmental Toxicology and Chemistry</i> 33(2):350-358.	92
4181705	Zeng, X., Mai, B., Sheng, G., Luo, X., Shao, W., An, T., Fu, J. (2008). Distribution of polycyclic musks in surface sediments from the Pearl River Delta and Macao Coastal Region, South china. <i>Environmental Toxicology and Chemistry</i> 27(1):18-23.	93
4181848	Yin, J., Wang, H., Li, J., Wu, Y., Shao, B. (2016). Occurrence of synthetic musks in human breast milk samples from 12 provinces in China. <i>Food Additives & Contaminants: Part A, Chemistry, Analysis, Control, Exposure & Risk Assessment</i> 33(7):1219-1227.	94
4182703	Maruya, K. A., Dodder, N. G., Sengupta, A., Smith, D. J., Lyons, J. M., Heil, A. T., Drewes, J. E. (2016). Multimedia screening of contaminants of emerging concern (CECS) in coastal urban watersheds in southern California (USA). <i>Environmental Toxicology and Chemistry</i> 35(8):1986-1994.	95
4196927	Cavalheiro, J., Zuloaga, O., Prieto, A., Preudhomme, H., Amouroux, D., Monperrus, M. (2017). Occurrence and Fate of Organic and Organometallic Pollutants in Municipal Wastewater Treatment Plants and Their Impact on Receiving Waters (Adour Estuary, France). <i>Archives of Environmental Contamination and Toxicology</i> 73(4):619-630.	96
4214525	Bizarro, C., Ros, O., Vallejo, A., Prieto, A., Etxebarria, N., Cajaraville, M. P., Ortiz-Zarragoitia, M. (2014). Intersex condition and molecular markers of endocrine disruption in relation with burdens of emerging pollutants in thicklip grey mullets (<i>Chelon labrosus</i>) from Basque estuaries (South-East Bay of Biscay). <i>Marine Environmental Research</i> 96:19-28.	97
4263040	Homem, V., Magalhães, I., Alves, A., Santos, L. (2017). Assessing seasonal variation of synthetic musks in beach sands from Oporto coastal area: A case study. <i>Environmental Pollution</i> 226:190-197.	98
4264179	Hutter, H. P., Wallner, P., Hartl, W., Uhl, M., Lorbeer, G., Gminski, R., Mersch-Sundermann, V., Kundi, M. (2010). Higher blood concentrations of synthetic musks in women above fifty years than in younger women. <i>International Journal of Hygiene and Environmental Health</i> 213(2):124-130.	99
4326553	Chase, D. A., Karnjanapiboonwong, A., Fang, Y., Cobb, G. P., Morse, A. N., Anderson, T. A. (2012). Occurrence of synthetic musk fragrances in effluent and non-effluent impacted environments. <i>Science of the Total Environment</i> 416:253-260.	100
4330586	Matamoras, V., Arias, C. A., Nguyen, L. X., Salvadó, V., Brix, H. (2012). Occurrence and behavior of emerging contaminants in surface water and a restored wetland. <i>Chemosphere</i> 88(9):1083-1089.	101
4618390	Barbosa, V., Maulvault, A. L., Alves, R. N., Kwadijk, C., Kotterman, M., Tediosi, A., Fernández-Tejedor, M., Sloth, J. J., Granby, K., Rasmussen, R. R., Robbens, J., De Witte, B., Trabalón, L., Fernandes, J. O., Cunha, S. C., Marques, A. (2018). Effects of steaming on contaminants of emerging concern levels in seafood. <i>Food and Chemical Toxicology</i> 118(Elsevier):490-504.	102
4729972	Baurès, E., Blanchard, O., Mercier, F., Surget, E., le Cann, P., Rivier, A., Gangneux, J. P., Florentin, A. (2018). Indoor air quality in two French hospitals: Measurement of chemical and microbiological contaminants. <i>Science of the Total Environment</i> 642:168-179.	103
4829919	Blum, K. M., Andersson, P. L., Ahrens, L., Wiberg, K., Haglund, P. (2018). Persistence, mobility and bioavailability of emerging organic contaminants discharged from sewage treatment plants. <i>Science of the Total Environment</i> 612:1532-1542.	104
4854965	Moldovan, Z., Marincas, O., Povar, I., Lupascu, T., Longree, P., Rota, J. S., Singer, H., Alder, A. C. (2018). Environmental exposure of anthropogenic micropollutants in the Prut River at the Romanian-Moldavian border: A snapshot in the lower Danube river basin. <i>Environmental Science and Pollution Research</i> 25(31):31040–31050.	105
4912133	Buszka, P. M., Yeskis, D. J., Kolpin, D. W., Furlong, E. T., Zaugg, S. D., Meyer, M. T. (2009). Waste-indicator and pharmaceutical compounds in landfill-leachate-affected ground water near Elkhart, Indiana, 2000-2002. <i>Bulletin of Environmental Contamination and Toxicology</i> 82(6):653-659.	106
5017218	Alvarez, D., Cranor, W., Perkins, S., Schroeder, V., Werner, W. (2008). Reconnaissance of Persistent and Emerging Contaminants in the Shenandoah and James River Basins, Virginia, During Spring of 2007. <i>GRA and I(e 1)</i> :20.	107
5017319	Biel-Maeso, M., Corada-Fernández, C., Lara-Martín, P. A. (2018). Removal of personal care products (PCPs) in wastewater and sludge treatment and their occurrence in receiving soils. <i>Water Research</i> 150:129-139.	108

5149743	Winkler, M., Kopf, G., Hauptvogel, C., Neu, T. (1998). Fate of artificial musk fragrances associated with suspended particulate matter (SPM) from the River Elbe (Germany) in comparison to other organic contaminants. <i>Chemosphere</i> 37(6):1139-1156.	109
5162636	Oros, D. R., Jarman, W. M., Lowe, T., David, N., Lowe, S., Davis, J. A. (2003). Surveillance for previously unmonitored organic contaminants in the San Francisco estuary. <i>Marine Pollution Bulletin</i> 46(9):1102-1110.	110
5163442	Zeng, X., Xu, L., Liu, J., Wu, Y., Yu, Z. (2017). Occurrence and distribution of organophosphorus flame retardants/plasticizers and synthetic musks in sediments from source water in the Pearl River Delta, China. <i>Environmental Toxicology and Chemistry</i> 37(4):975-982.	111
5298744	Page, D., Miotliński, K., Gonzalez, D., Barry, K., Dillon, P., Gallen, C. (2014). Environmental monitoring of selected pesticides and organic chemicals in urban stormwater recycling systems using passive sampling techniques. <i>Journal of Contaminant Hydrology</i> 158(Elsevier):65-77.	112
5305891	Gadelha, J. R., Rocha, A. C., Camacho, C., Eljarrat, E., Peris, A., Aminot, Y., Readman, J. W., Boti, V., Nannou, C., Kapsi, M., Albanis, T., Rocha, F., Machado, A., Bordalo, A., Valente, L. M. P., Nunes, M. L., Marques, A., Almeida, C. M. R. (2019). Persistent and emerging pollutants assessment on aquaculture oysters (<i>Crassostrea gigas</i>) from NW Portuguese coast (Ria De Aveiro). <i>Science of the Total Environment</i> 666:731-742.	113
5349141	Hu, Z., Shi, Y., Cai, Y. (2011). Concentrations, distribution, and bioaccumulation of synthetic musks in the Haihe River of China. <i>Chemosphere</i> 84(11):1630-1635.	114
5427809	Albrecht, C., Lorenz, W. (2014). Occurrence of synthetic musk compounds and their fate in the aquatic environment of the river Saale in Germany. <i>Fresenius Environmental Bulletin</i> 23(7):1455-1463.	115
5427811	Bargar, T. A., Garrison, V. H., Alvarez, D. A., Echols, K. R. (2013). Contaminants assessment in the coral reefs of Virgin Islands National Park and Virgin Islands Coral Reef National Monument. <i>Marine Pollution Bulletin</i> 70(1-2):281-288.	116
5427823	Arrubla, J. P., Cubillos, J. A., Ramirez, C. A., Arredondo, J. A., Arias, C. A., Paredes, D. (2016). Pharmaceutical and personal care products in domestic wastewater and their removal in anaerobic treatment systems: septic tank - up flow anaerobic filter. 36(1):70-78.	117
5427882	Winkler, M., Headley, J. V., Peru, K. M. (2000). Optimization of solid-phase microextraction for the gas chromatographic-mass spectrometric determination of synthetic musk fragrances in water samples. <i>Journal of Chromatography A</i> 903(1-2):203-210.	118
5427892	Yang, J. J., Metcalfe, C. D. (2006). Fate of synthetic musks in a domestic wastewater treatment plant and in an agricultural field amended with biosolids. <i>Science of the Total Environment</i> 363(1-3):149-165.	119
5427894	Zhang, X., Yao, Y., Zeng, X., Qian, G., Guo, Y., Wu, M., Sheng, G., Fu, J. (2008). Synthetic musks in the aquatic environment and personal care products in Shanghai, China. <i>Chemosphere</i> 72(10):1553-1558.	120
5427897	Yao, L., Lv, Y. Z., Zhang, L. J., Liu, W. R., Zhao, J. L., Yang, Y. Y., Jia, Y. W., Liu, Y. S., He, L. Y., Ying, G. G. (2019). Bioaccumulation and risks of 24 personal care products in plasma of wild fish from the Yangtze River, China. <i>Science of the Total Environment</i> 665:810-819.	121
5427898	Zeng, X., Sheng, G., Xiong, Y., Fu, J. (2005). Determination of polycyclic musks in sewage sludge from Guangdong, China using GC-EI-MS. <i>Chemosphere</i> 60(6):817-823.	122
5427899	Yao, L., Zhao, J. L., Liu, Y. S., Zhang, Q. Q., Jiang, Y. X., Liu, S., Liu, W. R., Yang, Y. Y., Ying, G. G. (2018). Personal care products in wild fish in two main Chinese rivers: Bioaccumulation potential and human health risks. <i>Science of the Total Environment</i> 621:1093-1102.	123
5427900	Yin, J., Wang, H., Zhang, J., Zhou, N., Gao, F., Wu, Y., Xiang, J., Shao, B. (2012). The occurrence of synthetic musks in human breast milk in Sichuan, China. <i>Chemosphere</i> 87(9):1018-1023.	124
5427902	Zhang, H., Kelly, B. C. (2018). Sorption and bioaccumulation behavior of multi-class hydrophobic organic contaminants in a tropical marine food web. <i>Chemosphere</i> 199:44-53.	125
5427904	Zeng, X. Y., Cao, S. X., Zhang, D. L., Gao, S. T., Yu, Z. Q., Li, H. R., Sheng, G. Y., Fu, J. M. (2012). Levels and distribution of synthetic musks and polycyclic aromatic hydrocarbons in sludge collected from Guangdong Province. <i>Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering</i> 47(3):389-397.	126
5427931	Tamura, I., Kimura, K., Kameda, Y., Nakada, N., Yamamoto, H. (2013). Ecological risk assessment of urban creek sediments contaminated by untreated domestic wastewater: potential contribution of antimicrobials and a musk fragrance. <i>Environmental Technology</i> 34(12):1567-1575.	127

5427939	Zouhar, L., Vavrova, M., Mravcova, L., Kubickova, K., Vecerek, V. (2012). Evaluation of wastewater contamination by musk compounds. <i>Fresenius Environmental Bulletin</i> 21(11A):3352-3356.	128
5427987	Trabalón, L., Cano-Sancho, G., Pocurull, E., Nadal, M., Domingo, J. L., Borrull, F. (2015). Exposure of the population of Catalonia (Spain) to musk fragrances through seafood consumption: Risk assessment. <i>Environmental Research</i> 143(Pt B):116-122.	129
5427988	Tseng, W. J., Tsai, S. W. (2019). Assessment of dermal exposures for synthetic musks from personal care products in Taiwan. <i>Science of the Total Environment</i> 669:160-167.	130
5428001	Wanda, E. M. M., Nyoni, H., Mamba, B. B., Msagati, T. A. M. (2017). Occurrence of Emerging Micropollutants in Water Systems in Gauteng, Mpumalanga, and North West Provinces, South Africa. <i>International Journal of Environmental Research and Public Health</i> 14(1):79.	131
5428002	Wang, Q., Kelly, B. C. (2018). Assessing bioaccumulation behaviour of hydrophobic organic contaminants in a tropical urban catchment. <i>Journal of Hazardous Materials</i> 358:366-375.	132
5428006	Ramirez, A. J., Brain, R. A., Usenko, S., Mottaleb, M. A., O'Donnell, J. G., Stahl, L. L., Wathen, J. B., Snyder, B. D., Pitt, J. L., Perez-Hurtado, P., Dobbins, L. L., Brooks, B. W., Chambliss, C. K. (2009). Occurrence of pharmaceuticals and personal care products in fish: results of a national pilot study in the United States. <i>Environmental Toxicology and Chemistry</i> 28(12):2587-2597.	133
5428034	Ramos, S., Homem, V., Santos, L. (2019). Simultaneous determination of synthetic musks and UV-filters in water matrices by dispersive liquid-liquid microextraction followed by gas chromatography tandem mass-spectrometry. <i>Journal of Chromatography A</i> 1590:47-57.	134
5428036	Reiner, J. L., Kannan, K. (2011). Polycyclic Musks in Water, Sediment, and Fishes from the Upper Hudson River, New York, USA. <i>Water, Air, and Soil Pollution</i> 214(1-4):335-342.	135
5428039	Ramos, S., Homem, V., Santos, L. (2019). Development and optimization of a QuEChERS-GC-MS/MS methodology to analyse ultraviolet-filters and synthetic musks in sewage sludge. <i>Science of the Total Environment</i> 651(Pt 2):2606-2614.	136
5428045	Reiner, J. L., Berset, J. D., Kannan, K. (2007). Mass flow of polycyclic musks in two wastewater treatment plants. <i>Archives of Environmental Contamination and Toxicology</i> 52(4):451-457.	137
5428046	Relic, D., Popovic, A., Dordevic, D., Caslavsky, J. (2017). Occurrence of synthetic musk compounds in surface, underground, waste and processed water samples in Belgrade, Serbia. <i>Environmental Earth Sciences</i> 76(3):1-10.	138
5428047	Ricking, M., Schwarzbauer, J., Hellou, J., Svenson, A., Zitko, V. (2003). Polycyclic aromatic musk compounds in sewage treatment plant effluents of Canada and Sweden - first results. <i>Marine Pollution Bulletin</i> 46(4):410-417.	139
5428048	Ribeiro, H., Ramos, S., Homem, V., Santos, L. (2017). Can coastline plant species be used as biosamplers of emerging contaminants? - UV-filters and synthetic musks as case studies. <i>Chemosphere</i> 184(Elsevier):1134-1140.	140
5428073	Saraiva, M., Cavalheiro, J., Lancelour, L., Monperrus, M. (2016). Synthetic musk in seafood products from south Europe using a quick, easy, cheap, effective, rugged and safe extraction method. <i>Food Chemistry</i> 200:330-335.	141
5428083	Sang, W., Zhang, Y., Zhou, X., Zhang, T. C. (2012). Spatial and seasonal distribution of synthetic musks in sewage treatment plants of Shanghai, China. <i>Water Science and Technology</i> 66(1):201-209.	142
5428089	Shek, W. M., Murphy, M. B., Lam, J. C. W., Lam, P. K. S. (2008). Polycyclic musks in green-lipped mussels (<i>Perna viridis</i>) from Hong Kong. <i>Marine Pollution Bulletin</i> 57(6-12):373-380.	143
5428090	Moldovan, Z., Schmutzer, G., Tusa, F., Calin, R., Alder, A. C. (2007). An overview of pharmaceuticals and personal care products contamination along the river Somes watershed, Romania. <i>Journal of Environmental Monitoring</i> 9(9):986-993.	144
5428096	Musolff, A., Leschik, S., Möder, M., Strauch, G., Reinstorf, F., Schirmer, M. (2009). Temporal and spatial patterns of micropollutants in urban receiving waters. <i>Environmental Pollution</i> 157(11):3069-3077.	145
5428105	Mottaleb, M. A., Usenko, S., O'Donnell, J. G., Ramirez, A. J., Brooks, B. W., Chambliss, C. K. (2009). Gas chromatography-mass spectrometry screening methods for select UV filters, synthetic musks, alkylphenols, an antimicrobial agent, and an insect repellent in fish. <i>Journal of Chromatography A</i> 1216(5):815-823.	146

5428132	Osenbrück, K., Gläser, H. R., Knöller, K., Weise, S. M., Möder, M., Wennrich, R., Schirmer, M., Reinstorf, F., Busch, W., Strauch, G. (2007). Sources and transport of selected organic micropollutants in urban groundwater underlying the city of Halle (Saale), Germany. <i>Water Research</i> 41(15):3259-3270.	147
5428155	Pintado-Herrera, M. G., Lara-Martín, P. A., González-Mazo, E., Allan, I. J. (2016). Determination of silicone rubber and low-density polyethylene diffusion and polymer/water partition coefficients for emerging contaminants. <i>Environmental Toxicology and Chemistry</i> 35(9):2162-2172.	148
5428185	Li, A. J., Feldman, S. M., McNally, R. K., Kannan, K. (2019). Distribution of organohalogen and synthetic musk compounds in breast adipose tissue of breast cancer patients in Ulster County, New York, USA. <i>Archives of Environmental Contamination and Toxicology</i> 77(1):68-78.	149
5428197	Kwon, J. W., Rodriguez, J. M. (2014). Occurrence and removal of selected pharmaceuticals and personal care products in three wastewater-treatment plants. <i>Archives of Environmental Contamination and Toxicology</i> 66(4):538-548.	150
5428198	Lee, H. B., Peart, T. E., Sarafin, K. (2003). Occurrence of polycyclic and nitro musk compounds in Canadian sludge and wastewater samples. <i>Water Quality Research Journal of Canada</i> 38(4):683-702.	151
5428206	Lange, C., Kuch, B., Metzger, J. W. (2015). Occurrence and fate of synthetic musk fragrances in a small German river. <i>Journal of Hazardous Materials</i> 282(Elsevier):34-40.	152
5428251	Lou, Y. H., Wang, J., Wang, L., Shi, L., ei, Yu, Y., ue, Zhang, M. Y. (2016). Determination of Synthetic Musks in Sediments of Yellow River Delta Wetland, China. <i>Bulletin of Environmental Contamination and Toxicology</i> 97(1):78-83.	153
5428263	Liu, N., Shi, Y., Li, W., Xu, L., Cai, Y. (2014). Concentrations and distribution of synthetic musks and siloxanes in sewage sludge of wastewater treatment plants in China. <i>Science of the Total Environment</i> 476-477(Elsevier):65-72.	154
5428264	Lu, B., Feng, Y., Gao, P., Zhang, Z. (2013). Occurrence and distribution of polycyclic musks in surface water from the Songhua River. <i>Advanced Materials Research</i> 726-731:1508-1511.	155
5428325	Hájková, K., Pulkrabová, J., Hajslová, J., Randák, T., Zlábek, V. (2007). Chub (<i>Leuciscus cephalus</i>) as a bioindicator of contamination of the Vltava River by synthetic musk fragrances. <i>Archives of Environmental Contamination and Toxicology</i> 53(3):390-396.	156
5428326	Heberer, T. (2003). Occurrence, fate, and assessment of polycyclic musk residues in the aquatic environment of urban areas - A review. <i>Acta Hydrochimica et Hydrobiologica</i> 30(5-6):227-243.	157
5428328	Mitjans, D., Ventura, F. (2005). Determination of fragrances at ng/L levels using CLSA and GC/MS detection. <i>Water Science and Technology</i> 52(10-11):145-150.	158
5428331	Herren, D., Berset, J. D. (2000). Nitro musks, nitro musk amino metabolites and polycyclic musks in sewage sludges - Quantitative determination by HRGC-ion-trap-MS/MS and mass spectral characterization of the amino metabolites. <i>Chemosphere</i> 40(5):565-574.	159
5428336	Hutter, H. P., Wallner, P., Moshhammer, H., Hartl, W., Sattelberger, R., Lorbeer, G., Kundi, M. (2009). Synthetic musks in blood of healthy young adults: relationship to cosmetics use. <i>Science of the Total Environment</i> 407(17):4821-4825.	160
5428337	Hu, Z., Shi, Y., Niu, H., Cai, Y., Jiang, G., Wu, Y. (2010). Occurrence of synthetic musk fragrances in human blood from 11 cities in China. <i>Environmental Toxicology and Chemistry</i> 29(9):1877-1882.	161
5428338	Hu, Z., Shi, Y., Cai, Y. (2011). Reprint of: Concentrations, distribution, and bioaccumulation of synthetic musks in the Haihe River of China. <i>Chemosphere</i> 85(2):262-267.	162
5428345	Hutter, H. P., Wallner, P., Moshhammer, H., Hartl, W., Sattelberger, R., Lorbeer, G., Kundi, M. (2005). Blood concentrations of polycyclic musks in healthy young adults. <i>Chemosphere</i> 59(4):487-492.	163
5428347	Hijosa-Valsero, M., Reyes-Contreras, C., Domínguez, C., Bécares, E., Bayona, J. M. (2016). Behaviour of pharmaceuticals and personal care products in constructed wetland compartments: Influent, effluent, pore water, substrate and plant roots. <i>Chemosphere</i> 145:508-517.	164
5428350	Hu, Z., Shi, Y., Zhang, S., Niu, H., Cai, Y. (2011). Assessment of synthetic musk fragrances in seven wastewater treatment plants of Beijing, China. <i>Bulletin of Environmental Contamination and Toxicology</i> 86(3):302-306.	165
5428378	Kannan, K., Reiner, J. L., Yun, S. H., Perrotta, E. E., Tao, L., Johnson-Restrepo, B., Rodan, B. D. (2005). Polycyclic musk compounds in higher trophic level aquatic organisms and humans from the United States. <i>Chemosphere</i> 61(5):693-700.	166

5428379	Jiang, S., Wang, L., Zheng, M., Lou, Y., Shi, L. (2018). Determination and environmental risk assessment of synthetic musks in the water and sediments of the Jiaozhou Bay wetland, China. <i>Environmental Science and Pollution Research</i> 25(5):4915-4923.	167
5428380	Gómez, M. J., Herrera, S., Solé, D., García-Calvo, E., Fernández-Alba, A. R. (2012). Spatio-temporal evaluation of organic contaminants and their transformation products along a river basin affected by urban, agricultural and industrial pollution. <i>Science of the Total Environment</i> 420(Elsevier):134-145.	168
5428384	Jenkins, J. A., Rosen, M. R., Draugelis-Dale, R. O., Echols, K. R., Torres, L., Wieser, C. M., Kersten, C. A., Goodbred, S. L. (2018). Sperm quality biomarkers complement reproductive and endocrine parameters in investigating environmental contaminants in common carp (<i>Cyprinus carpio</i>) from the Lake Mead National Recreation Area. <i>Environmental Research</i> 163:149-164.	169
5428385	Kallenborn, R., Gatermann, R., Planting, S., Rimkus, G. G., Lund, M., Schlabach, M., Burkow, I. C. (1999). Gas chromatographic determination of synthetic musk compounds in Norwegian air samples. <i>Journal of Chromatography A</i> 846(1-2):295-306.	170
5428388	Kinney, C. A., Furlong, E. T., Kolpin, D. W., Burkhardt, M. R., Zaugg, S. D., Werner, S. L., Bossio, J. P., Benotti, M. J. (2008). Bioaccumulation of pharmaceuticals and other anthropogenic waste indicators in earthworms from agricultural soil amended with biosolid or swine manure. <i>Environmental Science & Technology</i> 42(6):1863-1870.	171
5428390	Kameda, Y., Kimura, K., Miyazaki, M. (2011). Occurrence and profiles of organic sun-blocking agents in surface waters and sediments in Japanese rivers and lakes. <i>Environmental Pollution</i> 159(6):1570-1576.	172
5428395	Kinney, C. A., Furlong, E. T., Kolpin, D. W., Zaugg, S. D., Burkhardt, M. R., Bossio, J. P., Werner, S. L. (2010). Earthworms: Diagnostic indicators of wastewater derived anthropogenic organic contaminants in terrestrial environments. <i>ACS Symposium Series Volume 1048</i> 1048:297-317.	173
5428404	Cunha, S. C., Trabalón, L., Jacobs, S., Castro, M., Fernandez-Tejedor, M., Granby, K., Verbeke, W., Kwadijk, C., Ferrari, F., Robbens, J., Sioen, I., Pocurull, E., Marques, A., Fernandes, J. O., Domingo, J. L. (2018). UV-filters and musk fragrances in seafood commercialized in Europe Union: Occurrence, risk and exposure assessment. <i>Environmental Research</i> 161:399-408.	174
5428405	Den Hond, E., Paulussen, M., Geens, T., Bruckers, L., Baeyens, W., David, F., Dumont, E., Loots, I., Morrens, B., de Bellevaux, B. N., Nelen, V., Schoeters, G., Van Larebeke, N., Covaci, A. (2013). Biomarkers of human exposure to personal care products: results from the Flemish Environment and Health Study (FLEHS 2007-2011). <i>Science of the Total Environment</i> 463-464:102-110.	175
5428412	Dsikowitzky, L., Schwarzbauer, J., Littke, R. (2002). Distribution of polycyclic musks in water and particulate matter of the Lippe River (Germany). <i>Organic Geochemistry</i> 33(12):1747-1758.	176
5428439	Foltz, J., Abdul Mottaleb, M., Meziani, M. J., Rafiq Islam, M. (2014). Simultaneous detection and quantification of select nitromusks, antimicrobial agent, and antihistamine in fish of grocery stores by gas chromatography-mass spectrometry. <i>Chemosphere</i> 107:187-193.	177
5428446	Fromme, H., Otto, T., Pilz, K. (2001). Polycyclic musk fragrances in different environmental compartments in Berlin (Germany). <i>Water Research</i> 35(1):121-128.	178
5428450	Fromme, H., Otto, T., Pilz, K. (2001). Polycyclic musk fragrances in fish samples from Berlin waterways, Germany. <i>Food Additives and Contaminants</i> 18(11):937-944.	179
5428453	Gao, Q., Blum, K. M., Gago-Ferrero, P., Wiberg, K., Ahrens, L., Andersson, P. L. (2019). Impact of on-site wastewater infiltration systems on organic contaminants in groundwater and recipient waters. <i>Science of the Total Environment</i> 651(Pt. 2):1670-1679.	180
5428483	Che, J., Yu, R., Song, Q., Wang, L., Wu, S. F. (2011). Determination of synthetic musks in the sediment of the Taihu lake by using accelerated solvent extraction (ASE) and GC/MS. <i>International Journal of Environmental Analytical Chemistry</i> 91(4):387-399.	181
5428484	Chen, D., Zeng, X., Sheng, Y., Bi, X., Gui, H., Sheng, G., Fu, J. (2007). The concentrations and distribution of polycyclic musks in a typical cosmetic plant. <i>Chemosphere</i> 66(2):252-258.	182
5428490	Guo, G. H., Wu, F. C., He, H. P., Zhang, R. Q., Li, H. X. (2013). Screening level ecological risk assessment for synthetic musks in surface water of Lake Taihu, China. <i>Stochastic Environmental Research and Risk Assessment</i> 27(1):111-119.	183
5428491	Guo, R., Lee, I. S., Kim, U. J., Oh, J. E. (2010). Occurrence of synthetic musks in Korean sewage sludges. <i>Science of the Total Environment</i> 408(7):1634-1639.	184
5428493	Chen, F., Ying, G., Ma, Y., Chen, Z., Lai, H., Peng, F. J. (2014). Field dissipation and risk assessment of typical personal care products TCC, TCS, AHTN and HHCb in biosolid-amended soils. <i>Science of the Total Environment</i> 470:1078-1086.	185

5428501	Clara, M., Gans, O., Windhofer, G., Krenn, U., Hartl, W., Braun, K., Scharf, S., Scheffknecht, C. (2011). Occurrence of polycyclic musks in wastewater and receiving water bodies and fate during wastewater treatment. <i>Chemosphere</i> 82(8):1116-1123.	186
5428509	Chen, F., Ying, G. G., Ma, Y. B., Chen, Z. F., Lai, H. J. (2014). Field dissipation of four personal care products in biosolids-amended soils in North China. <i>Environmental Toxicology and Chemistry</i> 33(11):2413-2421.	187
5428556	Corada-Fernández, C., Candela, L., Torres-Fuentes, N., Pintado-Herrera, M. G., Paniw, M., González-Mazo, E. (2017). Effects of extreme rainfall events on the distribution of selected emerging contaminants in surface and groundwater: The Guadalete River basin (SW, Spain). <i>Science of the Total Environment</i> 605-606:770-783.	188
5428638	Blum, K. M., Haglund, P., Gao, Q., Ahrens, L., Gros, M., Wiberg, K., Andersson, P. L. (2018). Mass fluxes per capita of organic contaminants from on-site sewage treatment facilities. <i>Chemosphere</i> 201(Elsevier):864-873.	189
5428639	Bester, K. (2004). Retention characteristics and balance assessment for two polycyclic musk fragrances (HHCB and AHTN) in a typical German sewage treatment plant. <i>Chemosphere</i> 57(8):863-870.	190
5428640	Blanco, M., Fernandes, D., Rizzi, J., Huertas, D., Caiola, N., Fernández, P., Porte, C. (2018). The combined use of chemical and biochemical markers in <i>Rutilus rutilus</i> to assess the effect of dredging in the lower course of the Ebro River. <i>Ecotoxicology and Environmental Safety</i> 155:9-16.	191
5428644	Blanco, M., Rizzi, J., Fernandes, D., Colin, N., Maceda-Veiga, A., Porte, C. (2019). Assessing the impact of waste water effluents on native fish species from a semi-arid region, NE Spain. <i>Science of the Total Environment</i> 654:218-225.	192
5428648	Bester, K., Hühnerfuss, H., Lange, W., Rimkus, G. G., Theobald, N. (1998). Results of non target screening of lipophilic organic pollutants in the German Bight II: Polycyclic musk fragrances. <i>Water Research</i> 32(6):1857-1863.	193
5428650	Bester, K. (2005). Polycyclic musks in the Ruhr catchment area—transport, discharges of waste water, and transformations of HHCB, AHTN and HHCB-lactone. <i>Journal of Environmental Monitoring</i> 7(1):43-51.	194
5428652	Beretta, M., Britto, V., Tavares, T. M., da Silva, S. M. T., Pletsch, A. L. (2014). Occurrence of pharmaceutical and personal care products (PPCPs) in marine sediments in the Todos os Santos Bay and the north coast of Salvador, Bahia, Brazil. <i>Journal of Soils and Sediments</i> 14(7):1278-1286.	195
5428728	Carlos, G., Nicola, S., Leire, A., Sonia, P., Gustavo, F., Trish, F., Roy, L., James, R. (2007). Pharmaceuticals, personal care products, endocrine disruptors, fragrances and faecal steroids in sewage effluents, riverine, estuarine and coastal waters. :648-652.	196
5428730	Bueno, M. J., Gomez, M. J., Herrera, S., Hernando, M. D., Agüera, A., Fernández-Alba, A. R. (2012). Occurrence and persistence of organic emerging contaminants and priority pollutants in five sewage treatment plants of Spain: two years pilot survey monitoring. <i>Environmental Pollution</i> 164:267-273.	197
5431349	Rimkus, G. G., Wolf, M. (1996). Polycyclic musk fragrances in human adipose tissue and human milk. <i>Chemosphere</i> 33(10):2033-2043.	198
5431366	Klaschka, U., von der Ohe, P. C., Bschorer, A., Krezmer, S., Sengl, M., Letzel, M. (2013). Occurrences and potential risks of 16 fragrances in five German sewage treatment plants and their receiving waters. <i>Environmental Science and Pollution Research</i> 20(4):2456-2471.	199
5431371	Gatermann, R., Biselli, S., Hühnerfuss, H., Rimkus, G. G., Franke, S., Hecker, M., Kallenborn, R., Karbe, L., König, W. A. (2002). Synthetic Musks in the Environment. Part 2: Enantioselective Transformation of the Polycyclic Musk Fragrances HHCB, AHTN, AHDI, and ATII in Freshwater Fish. <i>Archives of Environmental Contamination and Toxicology</i> 42(4):447-453.	200
5431373	Horii, Y., Reiner, J. L., Loganathan, B. G., Senthil Kumar, K., Sajwan, K., Kannan, K. (2007). Occurrence and fate of polycyclic musks in wastewater treatment plants in Kentucky and Georgia, USA. <i>Chemosphere</i> 68(11):2011-2020.	201
5431376	Berset, J. D., Kupper, T., Etter, R., Tarradellas, J. (2004). Considerations about the enantioselective transformation of polycyclic musks in wastewater, treated wastewater and sewage sludge and analysis of their fate in a sequencing batch reactor plant. <i>Chemosphere</i> 57(8):987-996.	202
5431387	Buerge, I. J., Buser, H. R., Müller, M. D., Poiger, T. (2003). Behavior of the polycyclic musks HHCB and AHTN in lakes, two potential anthropogenic markers for domestic wastewater in surface waters. <i>Environmental Science & Technology</i> 37(24):5636-5644.	203
5431403	Gatermann, R., Biselli, S., Hühnerfuss, H., Rimkus, G. G., Hecker, M., Karbe, L. (2002). Synthetic musks in the environment. Part 1: Species-dependent bioaccumulation of polycyclic and nitro musk fragrances in freshwater fish and mussels. <i>Archives of Environmental Contamination and Toxicology</i> 42(4):437-446.	204

5431418	Brunsch, A. F., Langenhoff, A. A. M., Rijnaarts, H. H. M., Ahring, A., Ter Laak, T. L. (2019). In situ removal of four organic micropollutants in a small river determined by monitoring and modelling. <i>Environmental Pollution</i> 252(Pt A):758-766.	205
5431424	Zeng, X., Sheng, G., Gui, H., Chen, D., Shao, W., Fu, J. (2007). Preliminary study on the occurrence and distribution of polycyclic musks in a wastewater treatment plant in Guandong, China. <i>Chemosphere</i> 69(8):1305-1311.	206
5432871	Dodson, R. E., Bessonneau, V., Udesky, J. O., Nishioka, M., McCauley, M., Rudel, R. A. (2019). Passive indoor air sampling for consumer product chemicals: A field evaluation study. <i>Journal of Exposure Science & Environmental Epidemiology</i> 29(1):95-108.	207
5469315	Gourmelon, M., Caprais, M. P., Mieszkina, S., Marti, R., Wéry, N., Jardé, E., Derrien, M., Jadas-Hécart, A., Communal, P. Y., Jaffrezic, A., Pourcher, A. M. (2010). Development of microbial and chemical MST tools to identify the origin of the faecal pollution in bathing and shellfish harvesting waters in France. <i>Water Research</i> 44(16):4812-4824.	208
5469762	Giorgino, M. J., Rasmussen, R. B., Pfeifle, C. M. (2007). Occurrence of organic wastewater compounds in selected surface-water supplies, Triangle Area of North Carolina, 2002-2005. <i>Scientific Investigations Report</i> 2007-5054 :29.	209
5556411	Fromme, H., Lahrz, T., Piloty, M., Gebhart, H., Oddoy, A., Rüden, H. (2004). Occurrence of phthalates and musk fragrances in indoor air and dust from apartments and kindergartens in Berlin (Germany). <i>Indoor Air</i> 14(3):188-195.	210
5664394	Launay, M. A., Dittmer, U., Steinmetz, H. (2016). Organic micropollutants discharged by combined sewer overflows - Characterisation of pollutant sources and stormwater-related processes. <i>Water Research</i> 104:82-92.	211
5709422	Kronimus, A., Schwarzbauer, J., Dsikowitzky, L., Heim, S., Littke, R. (2004). Anthropogenic organic contaminants in sediments of the Lippe river, Germany. <i>Water Research</i> 38(16):3473-3484.	212
5740077	Stachel, B., Jantzen, E., Knoth, W., Kruger, F., Lepom, P., Oetken, M., Reincke, H., Sawal, G., Schwartz, R., Uhlig, S. (2005). The Elbe Flood in August 2002—Organic Contaminants in Sediment Samples Taken After the Flood Event. <i>Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering</i> 40(2):265-287.	213
5755270	Dodson, R. E., Udesky, J. O., Colton, M. D., Mccauley, M., Camann, D. E., Yau, A. Y., Adamkiewicz, G., Rudel, R. A. (2017). Chemical exposures in recently renovated low-income housing: Influence of building materials and occupant activities. <i>Environment International</i> 109:114-127.	214
5813584	Jenkins, J. A., Goodbred, S. L., Olivier, H. M., Draugelis-Dale, R. O., Alvarez, D. A. (2009). Effects of Wastewater Discharges on Endocrine and Reproductive Function of Western Mosquitofish (<i>Gambusia spp.</i>) and Implications for the Threatened Santa Ana Sucker (<i>Catostomus santaanae</i>). :46.	215
5821282	Hart, R. J., Taylor, H. E., Antweiler, R. C., Fisk, G. G., Anderson, G. M., Roth, D. A., Flynn, M. E., Peart, D. B., Truini, M., Barber, L. B. (2005). Physical and chemical characteristics of Knowles, Forgotten, and Moqui Canyons, and effects of recreational use on water quality, Lake Powell, Arizona and Utah. <i>U.S. Geological Survey</i> :116.	216
5918412	HEL, (2018). Occurrence, distribution and ecological risks of organophosphate esters and synthetic musks in sediments from the Hun River. <i>Ecotoxicology and Environmental Safety</i> 160:178-183.	217
5918994	Duedahl-Olesen, L., Cederberg, T., Pedersen, K. H., Hojgard, A. (2005). Synthetic musk fragrances in trout from danish fish farms and human milk. <i>Chemosphere</i> 61(3):422.	218
5919095	Kupper, T., Berset, J. D., Etter-Holzer, R., Furrer, R., Tarradellas, J. (2004). Concentrations and specific loads of polycyclic musks in sewage sludge originating from a monitoring network in switzerland. <i>Chemosphere</i> 54(8):1111.	219
5919136	O'Toole, S., Metcalfe, C. (2006). Synthetic musks in fish from urbanized areas of the Lower Great Lakes, Canada. <i>Journal of Great Lakes Research</i> 32(2):361-369.	220
5919173	Nilsen, E. B., Alvarez, D. (2011). Water-quality monitoring for a pilot piling removal field evaluation, Coal Creek Slough, Washington, 2008-09. :26.	221
5919271	Schwarzbauer, J., Littke, H. (2004). Quantitative evaluation of elbe river-derived organic marker compounds in sediment samples from the german bight. <i>Journal of Soils and Sediments</i> 4(3):177-183.	222
5919365	Verbruggen, E. M. J., Van Loon, W. M. G., M, Tonkes, M., Van Duijn, P., Seinen, W., Hermens, J. L. M. (1999). Biomimetic extraction as a tool to identify chemicals with high bioconcentration potential: An illustration by two fragrances in sewage treatment plant effluents and surface waters. <i>Environmental Science & Technology</i> 33(5):801-806.	223

6090337	Lorenzo-Toja, Y., Alfonsín, C., Amores, M. J., Aldea, X., Marin, D., Moreira, M. T., Feijoo, G. (2016). Beyond the conventional life cycle inventory in wastewater treatment plants. <i>Science of the Total Environment</i> 553(Elsevier):71-82.	224
6393969	Mercier, F., Gilles, E., Soulard, P., Mandin, C., Dassonville, C., Le Bot, B. (2020). On-line coupling of thermal extraction with gas chromatography / tandem mass spectrometry for the analysis of semivolatile organic compounds in a few milligrams of indoor dust. <i>Journal of Chromatography A</i> 1615:460768.	225
6814514	van Drooge, B. L., Rivas, I., Querol, X., Sunyer, J., Grimalt, J. O. (2020). Organic air quality markers of indoor and outdoor PM2.5 aerosols in primary schools from Barcelona. <i>International Journal of Environmental Research and Public Health</i> 17(10):3685.	226
6968217	Shin, H., Moschet, C., Young, T. M., Bennett, D. H. (2019). Measured concentrations of consumer product chemicals in California house dust: Implications for sources, exposure, and toxicity potential. <i>Indoor Air</i> 30(1):60-75.	227
7303021	COWI AS, (2018). Screening programme 2017: Suspected PBT compounds. :0-0.	228
Experimental		
1325358	Dodson, R. E., Nishioka, M., Standley, L. J., Perovich, L. J., Brody, J. G., Rudel, R. A. (2012). Endocrine disruptors and asthma-associated chemicals in consumer products. <i>Environmental Health Perspectives</i> 120(7):935-943.	229
1863036	Correia, P., Cruz, A., Santos, L., Alves, A. (2013). Human dermal exposure to galaxolide from personal care products. <i>International Journal of Cosmetic Science</i> 35(3):299-309.	230
1968024	Roosens, L., Covaci, A., Neels, H. (2007). Concentrations of synthetic musk compounds in personal care and sanitation products and human exposure profiles through dermal application. <i>Chemosphere</i> 69(10):1540-1547.	232
5427894	Zhang, X., Yao, Y., u, Zeng, X., Qian, G., Guo, Y., Wu, M., Sheng, G., Fu, J. (2008). Synthetic musks in the aquatic environment and personal care products in Shanghai, China. <i>Chemosphere</i> 72(10):1553-1558.	233
5427988	Tseng, W. J., Tsai, S. W. (2019). Assessment of dermal exposures for synthetic musks from personal care products in Taiwan. <i>Science of the Total Environment</i> 669:160-167.	234
5428043	Reiner, J. L., Kannan, K. (2006). A survey of polycyclic musks in selected household commodities from the United States. <i>Chemosphere</i> 62(6):867-873.	235
5428493	Chen, F., Ying, G., Ma, Y., iB, Chen, Z., Lai, H., Peng, F. J. (2014). Field dissipation and risk assessment of typical personal care products TCC, TCS, AHTN and HHCB in biosolid-amended soils. <i>Science of the Total Environment</i> 470:1078-1086.	236
6301725	Lu, Y., Yuan, T., Wenhua, W., Kannan, K. (2011). Concentrations and assessment of exposure to siloxanes and synthetic musks in personal care products from China. <i>Environmental Pollution</i> 159(12):3522-3528.	237
Database		
10709400	U.S. EPA, U., S.G.S. and National Water Quality Monitoring Council (2022). (1,3,4,6,7,8-Hexahydro-4,6,6,7,8,8-hexamethylcyclopenta [g]-2-benzopyran (HHCB) (CAS RN: 1222-05-5): WQP Output (NWIS, STEWARDS & STORET), Site data & sample results (physical/chemical metadata).	238
Completed Assessment		
1402874	Langdon, K. A., Warne, M. S., Kookana, R. S. (2010). Aquatic hazard assessment for pharmaceuticals, personal care products, and endocrine-disrupting compounds from biosolids-amended land. <i>Integrated Environmental Assessment and Management</i> 6(4):663-676.	239
5155574	ECB, (2008). European Union risk assessment report: 1,3,4,6,7,8-hexahydro-4,6,6,7,8,8-hexamethylcyclopenta- γ -2-benzopyran (HHCB).	240
5349126	Balk, F., Ford, R. A. (1999). Environmental risk assessment for the polycyclic musks AHTN and HHCB in the EU. I. Fate and exposure assessment. <i>Toxicology Letters</i> 111(1-2):57-79.	241
5427931	Tamura, I., Kimura, K., Kameda, Y., Nakada, N., Yamamoto, H. (2013). Ecological risk assessment of urban creek sediments contaminated by untreated domestic wastewater: potential contribution of antimicrobials and a musk fragrance. <i>Environmental Technology</i> 34(12):1567-1575.	242

5428397	Fan, B.,o, Wang, X., Li, J.,i, Gao, X., Li, W., Huang, Y.,un, Liu, Z. (2019). Deriving aquatic life criteria for galaxolide (HHCB) and ecological risk assessment. <i>Science of the Total Environment</i> 681:488-496.	243
Modeling		
1249442	Schlumpf, M., Kypke, K., Wittassek, M., Angerer, J., Mascher, H., Mascher, D., Vökt, C., Birchler, M., Lichtensteiger, W. (2010). Exposure patterns of UV filters, fragrances, parabens, phthalates, organochlor pesticides, PBDEs, and PCBs in human milk: correlation of UV filters with use of cosmetics. <i>Chemosphere</i> 81(10):1171-1183.	244
1315313	Weschler, C. J., Nazaroff, W. W. (2012). SVOC exposure indoors: Fresh look at dermal pathways. <i>Indoor Air</i> 22(5):356-377.	245
2095404	Lu, Y.,an, Yuan, T.,ao, Yun, S., Wang, W., Kannan, K. (2011). Occurrence of synthetic musks in indoor dust from China and implications for human exposure. <i>Archives of Environmental Contamination and Toxicology</i> 60(1):182-189.	246
2215665	Shin, H. M., Mckone, T. E., Nishioka, M. G., Fallin, M. D., Croen, L. A., Hertz-Picciotto, I., Newschaffer, C. J., Bennett, D. H. (2014). Determining source strength of semivolatile organic compounds using measured concentrations in indoor dust. <i>Indoor Air</i> 24(3):260-271.	247
2541915	Villa, S., Vighi, M., Finizio, A. (2014). Theoretical and experimental evidences of medium range atmospheric transport processes of polycyclic musk fragrances. <i>Science of the Total Environment</i> 481(1):27-34.	248
2919589	Calderón-Preciado, D., Matamoros, V., Bayona, J. M. (2011). Occurrence and potential crop uptake of emerging contaminants and related compounds in an agricultural irrigation network. <i>Science of the Total Environment</i> 412-413:14-19.	249
3454652	Wei, W., Mandin, C., Blanchard, O., Mercier, F., Pelletier, M., Le Bot, B., Glorennec, P., Ramalho, O. (2017). Predicting the gas-phase concentration of semi-volatile organic compounds from airborne particles: Application to a French nationwide survey. <i>Science of the Total Environment</i> 576(Elsevier):319-325.	250
3466062	Kapo, K. E., Deleo, P. C., Vamshi, R., Holmes, C. M., Ferrer, D., Dyer, S. D., Wang, X., White-Hull, C. (2016). iSTREEM(®) : An approach for broad-scale in-stream exposure assessment of "down-the-drain" chemicals. <i>Integrated Environmental Assessment and Management</i> 12(4):782-792.	251
3602893	Pelletier, M., Bonvallot, N., Ramalho, O., Blanchard, O., Mercier, F., Mandin, C., Le Bot, B., Glorennec, P. (2017). Dermal absorption of semivolatile organic compounds from the gas phase: Sensitivity of exposure assessment by steady state modeling to key parameters. <i>Environment International</i> 102:106-113.	252
4165791	Pelletier, M., Bonvallot, N., Ramalho, O., Mandin, C., Wei, W., Raffy, G., Mercier, F., Blanchard, O., Le Bot, B., Glorennec, P. (2017). Indoor residential exposure to semivolatile organic compounds in France. <i>Environment International</i> 109:81-88.	253
4196927	Cavalheiro, J., Zuloaga, O., Prieto, A., Preudhomme, H., Amouroux, D., Monperrus, M. (2017). Occurrence and Fate of Organic and Organometallic Pollutants in Municipal Wastewater Treatment Plants and Their Impact on Receiving Waters (Adour Estuary, France). <i>Archives of Environmental Contamination and Toxicology</i> 73(4):619-630.	254
5043472	Wei, W., Mandin, C., Blanchard, O., Mercier, F., Pelletier, M., Le Bot, B., Glorennec, P., Ramalho, O. (2019). Semi-volatile organic compounds in French dwellings: An estimation of concentrations in the gas phase and particulate phase from settled dust. <i>Science of the Total Environment</i> 650 Pt. 2:2742-2750.	255
5427894	Zhang, X., Yao, Y.,u, Zeng, X., Qian, G., Guo, Y., Wu, M., Sheng, G., Fu, J. (2008). Synthetic musks in the aquatic environment and personal care products in Shanghai, China. <i>Chemosphere</i> 72(10):1553-1558.	256
5427988	Tseng, W. J., Tsai, S. W. (2019). Assessment of dermal exposures for synthetic musks from personal care products in Taiwan. <i>Science of the Total Environment</i> 669:160-167.	257
5428093	Schwartz, S., Berding, V., Matthies, M. (2000). Aquatic fate assessment of the polycyclic musk fragrance HHCB - Scenario and variability analysis in accordance with the EU risk assessment guidelines. <i>Chemosphere</i> 41(5):671-679.	258
5428125	Ortiz de Garcia, S., Pinto Pinto, G., Garcia Encina, P., Irusta Mata, R. (2013). Consumption and occurrence of pharmaceutical and personal care products in the aquatic environment in Spain. <i>Science of the Total Environment</i> 444(Elsevier):451-465.	259
5428335	Homem, V., Silva, E., Alves, A., Santos, L. (2015). Scented traces - Dermal exposure of synthetic musk fragrances in personal care products and environmental input assessment. <i>Chemosphere</i> 139:276-287.	260

5428404	Cunha, S. C., Trabalón, L., Jacobs, S., Castro, M., Fernandez-Tejedor, M., Granby, K., Verbeke, W., Kwadijk, C., Ferrari, F., Robbens, J., Sioen, I., Pocurull, E., Marques, A., Fernandes, J. O., Domingo, J. L. (2018). UV-filters and musk fragrances in seafood commercialized in Europe Union: Occurrence, risk and exposure assessment. <i>Environmental Research</i> 161:399-408.	261
5428645	Berding, V., Koormann, F., Schwartz, S., Wagner, J. O., Matthies, M. (2001). Spatial refinement of regional exposure assessment. <i>NATO Science Series IV Earth and Environmental Sciences</i> 2:205-222.	262
5431413	Federle, T., Sun, P., Dyer, S., Kiel, B. (2014). Probabilistic assessment of environmental exposure to the polycyclic musk, HHCB and associated risks in wastewater treatment plant mixing zones and sludge amended soils in the United States. <i>Science of the Total Environment</i> 493:1079-1087.	263
12952530	Hubbard, H. F., Ring, C. L., Hong, T., Henning, C. C., Vallero, D. A., Egeghy, P. P., Michael-Rock, G. (2022). Exposure Prioritization (Ex Priori): A screening-level high-throughput chemical prioritization tool. <i>Toxics</i> 10(10):569.	264
Glossary of Select Terms for Data Evaluation Tables		265

Study Citation:		Peck, A. M., Hornbuckle, K. C. (2006). Synthetic musk fragrances in urban and rural air of Iowa and the Great Lakes. Atmospheric Environment 40(32):6101-6111.		
HERO ID:		118402		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology detailed including sampling time and equipment. Sample transport back to the lab described but no storage temperature reported.
	Metric 2:	Analytical Methodology	High	Reports "minimum reporting limit" rather than LOD or LOQ
	Metric 3:	Biomarker Selection	N/A	air sampling
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Iowa and the Great Lakes
	Metric 5:	Currency	Low	Published in 2006 but all sampling occurred prior to 2003
	Metric 6:	Spatial and Temporal Variability	Medium	Samples for a single location vary from 3 to 85
	Metric 7:	Exposure Scenario	High	Urban, suburban, and rural air exposures
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	2000-2002
	Metric 9:	Quality Assurance	Low	Blanks used, but didn't see recoveries mentioned.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Statistical comparisons made between sites.
Overall Quality Determination			Medium	

Study Citation:		Sumner, N. R., Guitart, C., Fuentes, G., Readman, J. W. (2010). Inputs and distributions of synthetic musk fragrances in an estuarine and coastal environment; a case study. Environmental Pollution 158(1):215-222.		
HERO ID:		386594		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	sampling fully explained; samples filtered
	Metric 2:	Analytical Methodology	Medium	analyzed by programmable temperature vaporisation (inlet)-gas chromatography mass spectrometry (PTV-GC/MS); % recoveries Table 1; LODs 3 times std of lowest detectable standard and were 0.3-1.2 ng/L for water, 1.1-8.0ng/l for effluent, and 1.1-8.0 ng/g d.w. for SPM
	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	Tamar Estuary in SW peninsula of Cornwall and Devon, UK see 2.1 - Area of study and sampling strategy
	Metric 5:	Currency	Medium	2007
	Metric 6:	Spatial and Temporal Variability	Medium	11 stations, sampled in June and July, sampled in triplicate; use of replicates
	Metric 7:	Exposure Scenario	High	surface water, sediment, and effluent
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Table 2 concentration in effluent; concentrations in surface waters presented in Fig 2; sediment discussed in text on p.219 and fig. 3
	Metric 9:	Quality Assurance	High	3 recovery experiments were performed to assess the accuracy and precision of the analytical protocol; recovery 100%
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	temporal variations discussed in section 3.3; see Table 3
Overall Quality Determination			Medium	

Study Citation:		Peck, A. M., Linebaugh, E. K., Hornbuckle, K. C. (2006). Synthetic musk fragrances in Lake Erie and Lake Ontario sediment cores. Environmental Science & Technology 40(18):5629-5635.		
HERO ID:		509549		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	sampling information provided in detail
	Metric 2:	Analytical Methodology	Medium	specific LODs per chemical not provided; only a range
	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	Figure 1 provides sediment sampling location in Lake Erie and Lake Ontario
	Metric 5:	Currency	Low	August 7-12, 2003
	Metric 6:	Spatial and Temporal Variability	Low	sampled 6 days in August; Fig 1 seems to depict only one sample location in each lake; each box core was sub-cored (31-34); 4-6 tubes inserted into box core sediment; not clear the number of samples
	Metric 7:	Exposure Scenario	Medium	great lakes sediments
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	range in Lake Erie provided p.5; Table 2 provides dry wt surface concentration; other parameters not provided in main document; also not provided in SI which is attached
	Metric 9:	Quality Assurance	Medium	recovery and blank correction discussed p.4
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	p.5-6 compares concentrations found to other studies; end of p.8 discusses variability briefly; no std or other measurement of variation
Overall Quality Determination			Medium	

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

Study Citation:		Aguayo, S., Munoz, M. J., de La, T. A., Roset, J., de La, P. E., Carballo, M. (2004). Identification of organic compounds and ecotoxicological assessment of sewage treatment plants (STP) effluents. Science of the Total Environment 328(1-3):69-81.		
HERO ID:		679135		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Samples of effluent, simple description.
	Metric 2:	Analytical Methodology	High	Solid phase extraction; GC/MS.
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Spain, Madrid
	Metric 5:	Currency	Low	June, July 2000
	Metric 6:	Spatial and Temporal Variability	Medium	N = 7 sewage treatment plants (STPs): one 24-hour composite samples (twelve 2-L samples taken every 2 hours); also one 10-L grab sample at two facilities.
	Metric 7:	Exposure Scenario	Low	Effluent not an exposure medium (diluted by receiving water).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Reported # (%) of facilities (out of 7) for which chemical was detected in effluent and approximate DL.
	Metric 9:	Quality Assurance	Low	Not described, but "detection" was the only endpoint.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Limited to proportion of 7 facilities for which chemical was detected in effluent.
Overall Quality Determination			Low	

Study Citation:		Bidwell, J., Becker, C., Hensley, S., Stark, R., Meyer, M. (2010). Occurrence of organic wastewater and other contaminants in cave streams in northeastern Oklahoma and northwestern Arkansas. Archives of Environmental Contamination and Toxicology 58(2):286-298.		
HERO ID:		697423		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Samples were collected according to publicly available SOPs that are scientifically sound and widely accepted (i.e., from trusted or authoritative source) for the chemical and media of interest. Limit of detection is unclear/not discussed the study is testing for the parent chemical in an environmental media.
	Metric 2:	Analytical Methodology	Low	
	Metric 3:	Biomarker Selection	N/A	
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Northeastern Oklahoma and Northwestern Arkansas
	Metric 5:	Currency	Medium	May through June 2006
	Metric 6:	Spatial and Temporal Variability	Low	only 1 sample per location; no replica samples
	Metric 7:	Exposure Scenario	Medium	cave water is not as applicable as traditional streams
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	concentration not calculated; compounds detected given in ng analyte/polar organic chemical integrative samplers (POCISs) or semipermeable membranedeices (SPMDs); no ranges, percentiles, n, or variation provided
	Metric 9:	Quality Assurance	Medium	Compounds detected but not in field blanks, or that exceeded an arbitrary threshold of 2x the compound mass in the field blank, were considered more likely to represent actual water contaminants at a site.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	conclusion discusses variability and uncertainty
Overall Quality Determination			Medium	

Study Citation:		Chen, X., Pauly, U., Rehfus, S., Bester, K. (2009). Personal care compounds in a reed bed sludge treatment system. Chemosphere 76(8):1094-1101.		
HERO ID:		697481		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling method is not from a SOP but sampling methodology is clear, fully described, and important information provided.
	Metric 2:	Analytical Methodology	High	Methodology is appropriate. Pertinent sampling information is provided such as LOD, LOQ, instrumentation, recoveries, calibrations etc.
	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	Meppen
	Metric 5:	Currency	Medium	Samples collected from June, 2006 to July 2007.
	Metric 6:	Spatial and Temporal Variability	High	High score for soil samples because 10 samples were collected. However, low score for water because only 2 samples collected. Replicate samples were collected.
	Metric 7:	Exposure Scenario	High	Sludge and drainage water from the WWTP.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data not provided. Only point measurement of concentrations.
	Metric 9:	Quality Assurance	High	QA procedure such as recoveries and LOQ were discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study addressed some method uncertainty. But limitation and variation is not well-discussed.
Overall Quality Determination			High	

Study Citation:		Paxeus, N. (1996). Organic pollutants in the effluents of large wastewater treatment plants in Sweden. Water Research 30(5):1115-1122.		
HERO ID:		791113		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Pages 1115-116 provides information on WWTPs and filtered sampling.
	Metric 2:	Analytical Methodology	Low	The study used GC-MS for sample analysis; no reporting or detection limits provided.
	Metric 3:	Biomarker Selection	N/A	Testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Three WWTPs - in Stockholm, Goteborg, and Malmo Sweden.
	Metric 5:	Currency	Low	Samples collected December 1993 and January 1994
	Metric 6:	Spatial and Temporal Variability	Medium	Daily composite samples collected 1 week at SSW, 1 month at GYAAB, and 1 week at HST; one sample per plant by combining daily composites.
	Metric 7:	Exposure Scenario	High	Effluent from 3 largest WWTPs in Sweden.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	The study reports single concentration at each WWTP; no other data provided; no SI.
	Metric 9:	Quality Assurance	Low	The study does not discuss QA/QC; say range of concentration of all three WWTP in agreement with another paper.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	no discussion/information on variability and uncertainty
Overall Quality Determination			Medium	

Study Citation:		Schlumpf, M., Kypke, K., Wittassek, M., Angerer, J., Mascher, H., Mascher, D., Vökt, C., Birchler, M., Lichtensteiger, W. (2010). Exposure patterns of UV filters, fragrances, parabens, phthalates, organochlor pesticides, PBDEs, and PCBs in human milk: correlation of UV filters with use of cosmetics. Chemosphere 81(10):1171-1183.		
HERO ID:		1249442		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology discussed extensively in terms of sampling equipment, procedures, storage, and study site (participants’ homes). Insufficient information on duration of sample storage time prior to sample analysis.
	Metric 2:	Analytical Methodology	Medium	Extraction methodology, analytical instrumentation for HHCB (galaxolide): GC/ECD, GC/MSD, matrix lipid adjustment for HHCB, and LOD specifically for HHCB. Analytic methods noted as following European standardized methods. Insufficient information on instrument calibration, recovery rates for chemicals of interest.
	Metric 3:	Biomarker Selection	N/A	N/A — Sampling for parent chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Switzerland
	Metric 5:	Currency	Medium	HHCB sampling 2004-2006.
	Metric 6:	Spatial and Temporal Variability	Medium	Daily breast milk samples pooled and analyzed for n=13 HHCB samples, non-statistical sampling approach.
	Metric 7:	Exposure Scenario	Medium	Breast milk samples from women with insufficient information on profession/occupation (although present and past profession data collected within survey, authors noted it as not sufficiently detailed for use within analysis). Lack of field blank/exposure controls.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Breast milk sample lipid-adjusted concentration summary statistics reported as means with SD, median, 95th percentile, and range for year of sampling with number of samples analyzed and number of positive detected samples. Location of sampling described as at home of participant. Insufficient information on raw data sampling results.
	Metric 9:	Quality Assurance	Medium	Documented quality control measures according to referenced guidelines for analysis of HHCB samples, laboratory blanks, and quality assurance measures in sampling procedures in terms of trained personnel assistance in breast milk sampling, training of mothers in procedures and adherence to procedures insuring lack of sample contamination. Insufficient information on correction for blank concentrations, lack of baseline/pre-exposure sampling.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Sampling variability characterized and ranges of exposures for each chemical presented. Authors note most reported concentrations similar to previous European publications, however discussion of study limitations/uncertainties lacking.
Overall Quality Determination			Medium	

Study Citation:		Reyes-Contreras, C., Matamoros, V., Ruiz, I., Soto, M., Bayona, J. M. (2011). Evaluation of PPCPs removal in a combined anaerobic digester-constructed wetland pilot plant treating urban wastewater. Chemosphere 84(9):1200-1207.		
HERO ID:		1249709		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Methodology description is brief. No mention of how sampling equipment was cleaned before sampling.
	Metric 2:	Analytical Methodology	High	GC-MS method described and LOD provided.
	Metric 3:	Biomarker Selection	N/A	Chemical measured in wastewater
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Galicia, Spain
	Metric 5:	Currency	Medium	2008-2009
	Metric 6:	Spatial and Temporal Variability	Medium	24 water samples collected for each campaign. 3 sludge samples per campaign. No indication of replicate sampling or analysis.
	Metric 7:	Exposure Scenario	Medium	Sampling was at experimental pilot plant and potential exposure scenario did not seem directly relevant to a population.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data provided. Summary statistics used for presenting results.
	Metric 9:	Quality Assurance	Low	Very little description of QA/QC methods. Surrogate spiking and recovery mentioned but numbers not reported. Procedural blanks briefly mentioned but other controls were not clear.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Little discussion of variability of results and limitations of study.
Overall Quality Determination			Medium	

Study Citation:		Moon, H. B., An, Y. R., Choi, S. G., Choi, M., Choi, H. G. (2012). Accumulation of PAHs and synthetic musk compound in minke whales (<i>Balaenoptera acutorostrata</i>) and long-beaked common dolphins (<i>Delphinus capensis</i>) from Korean coastal waters. <i>Environmental Toxicology and Chemistry</i> 31(3):477-485.		
HERO ID:		1467354		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	sampling explained
	Metric 2:	Analytical Methodology	High	LOQ and analytical method described
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	East coast of Korea
	Metric 5:	Currency	Medium	2006
	Metric 6:	Spatial and Temporal Variability	Medium	number of samples analyzed range from 7-12
	Metric 7:	Exposure Scenario	High	exposure scenario explained
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Good presentation of results with no major issues.
	Metric 9:	Quality Assurance	High	quality control issues discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	compared to previous studies
Overall Quality Determination			High	

Study Citation: Gatermann, R., Hellou, J., Huehnerfuss, H., Rimkus, G., Zitko, V. (1999). Polycyclic and nitro musks in the environment: A comparison between Canadian and European aquatic biota. Chemosphere 38(14):3431-3441.

HERO ID: 1487274

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling Methodology	High	Sampling fully explained.
	Metric 2: Analytical Methodology	High	LOQ and analytical method described in detail.
	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	Cap-PelC and Charlotte County, New Brunswick, Canada.
	Metric 5: Currency	Critically Deficient	Does not provide sampling year; however the publication year of 1999 is used as a proxy for sampling year.
	Metric 6: Spatial and Temporal Variability	High	11 species sampled.
	Metric 7: Exposure Scenario	High	Exposure scenario described in detail.
Domain 3: Accessibility/Clarity			
	Metric 8: Reporting of Results	High	Raw data and statistical analysis results reported and described.
	Metric 9: Quality Assurance	High	QA/QC issues identified and discussed.
Domain 4: Variability and Uncertainty			
	Metric 10: Variability and Uncertainty	Low	Variability and uncertainty are not discussed.

Overall Quality Determination

Uninformative

Study Citation:		Arukwe, A., Eggen, T., Moeder, M. (2012). Solid waste deposits as a significant source of contaminants of emerging concern to the aquatic and terrestrial environments - A developing country case study from Owerri, Nigeria. Science of the Total Environment 438(Elsevier):94-102.		
HERO ID:		1597705		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	site and sampling discussed
	Metric 2:	Analytical Methodology	High	GC-MS; limits of quantification 1 ng/L (p.97)
	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	Owerri municipal solid waste dump site in Imo State, Nigeria
	Metric 5:	Currency	Medium	October 2011
	Metric 6:	Spatial and Temporal Variability	Low	sampled 1 day, 2 h after heavy rain; 4 sampling locations within the dump site selected arbitrarily to scan entire site
	Metric 7:	Exposure Scenario	High	sediment and run-off water from a solid waste dump site which seeps into groundwater
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1 provides concentration; no measured variation
	Metric 9:	Quality Assurance	Medium	blank analysis performed; two replicates for each calculation; std of sample duplicates ranged from 2-23% (p.97)
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	compared finding to previous studies p. 101 and Table 3
Overall Quality Determination			Medium	

Study Citation:		Andresen, J. A., Muir, D., Ueno, D., Darling, C., Theobald, N., Bester, K. (2007). Emerging pollutants in the North Sea in comparison to Lake Ontario, Canada, data. Environmental Toxicology and Chemistry 26(6):1081-1089.		
HERO ID:		1619118		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
Metric 1:	Sampling Methodology	High	Sample collection is reported for the German Bight sites including sampling methods, dates, and storage conditions.Uninformative for the Lake Ontario samples, the study only reports sample characteristics and coordinates.	
Metric 2:	Analytical Methodology	High	Analytical methods reported including extraction type, analytical instrumentation, and LOD.	
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 the North Sea (German Bight) and Lake Ontario, Canada. Tables S1 and S2 report sample coordinates.	
Metric 5:	Currency	Medium	Samples from the German Bight were collected from May 25, 2005, to June 6,2005.sample collection date for the Lake Ontario data is not provided.	
Metric 6:	Spatial and Temporal Variability	High	Table S1 reports 14 samples for the German Bight. 6 samples collected from Lake Ontario.	
Metric 7:	Exposure Scenario	High	The study reports the concentration of emergent contaminants in the North Sea and compares data with Lake Ontario. The discussion section mentions microenvironment exposure scenarios.	
Domain 3: Accessibility/Clarity				
Metric 8:	Reporting of Results	Low	Data for the German Bight is only reported in the figures with some information of minimum and maximum in the text.Lake Ontario data includes individual data points reported in table S4.	
Metric 9:	Quality Assurance	High	Data regarding the QA/QC is reported in the supplemental file.	
Domain 4: Variability and Uncertainty				
Metric 10:	Variability and Uncertainty	Medium	Some discussion of uncertainty provided.	
Overall Quality Determination			High	

Study Citation:		Teijon, G., Candela, L., Tamoh, K., Molina-Díaz, A., Fernández-Alba, A. R. (2010). Occurrence of emerging contaminants, priority substances (2008/105/CE) and heavy metals in treated wastewater and groundwater at Depurbaix facility (Barcelona, Spain). Science of the Total Environment 408(17):3584-3595.		
HERO ID:		1794878		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	State standard sampling from network of monitoring wells; sampling described in detail elsewhere.
	Metric 2:	Analytical Methodology	Medium	State and University analytic methods; identified but not described; liquid-liquid extraction, GC.
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Spain, near Mediterranean Sea; map of monitoring locations.
	Metric 5:	Currency	Medium	2007, 2008
	Metric 6:	Spatial and Temporal Variability	Medium	Bimonthly samples from tertiary WWT plant effluent and nearby groundwater (gw); total 8 effluent samples and 77 gw samples from 8 gw monitoring wells in area of reclaimed water injection to gw.
	Metric 7:	Exposure Scenario	Low	Effluent from wastewater tertiary treatment plant ("reclaimed" water before injection into aquifer) and nearby groundwater.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Min, max, mean, standard deviation, and % > DL.
	Metric 9:	Quality Assurance	Low	Not described; presumably high with university and state water quality agency analysis of samples.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Major sources of uncertainty noted, temporal and spatial variance quantified.
Overall Quality Determination			Medium	

Study Citation:		Lv, Y., Yuan, T., Hu, J., Wang, W. (2010). Seasonal occurrence and behavior of synthetic musks (SMs) during wastewater treatment process in Shanghai, China. Science of the Total Environment 408(19):4170-4176.		
HERO ID:		1964555		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Good description of sampling methodology provided.
	Metric 2:	Analytical Methodology	High	Detailed description of analytical methodology provided.
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	Medium	2007-2008.
	Metric 6:	Spatial and Temporal Variability	Medium	Only 1 WWTP sampled, but sampling conducted over 4 seasons and each season sampling was collected at 3 individual sampling events.
	Metric 7:	Exposure Scenario	Medium	Limited characterization of WWTP provided (30% industrial and 7-% residential).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only range provided in the text, but more stats should be in the SI.
	Metric 9:	Quality Assurance	High	Recoveries in acceptable range, no correction needed. Blanks used.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability was examined using seasonal samples. Correlated occurrence of musks with product usage.
Overall Quality Determination			Medium	

Study Citation:		Sang, W., Zhang, Y., Zhou, X., Ma, L., Sun, X. (2012). Occurrence and Distribution of Synthetic Musks in Surface Sediments of Liangtan River, West China. Environmental Engineering Science 29(1):19-25.		
HERO ID:		1968396		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	site characteristics and sampling equipment/regime/procedures discussed (p. 20)
	Metric 2:	Analytical Methodology	High	GC-MS; analyzed in triplicates; LOQ 10 ug/kg
	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	Liangtan river, Chongping region, West China
	Metric 5:	Currency	Medium	July 2009
	Metric 6:	Spatial and Temporal Variability	Medium	16 sampling sites along the river; only collected in July
	Metric 7:	Exposure Scenario	High	river sediments in China
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	variance and detailed statistics not provided; HHCB detected in 14 samples
	Metric 9:	Quality Assurance	High	recovery in sediment 81.2% (table 3)
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	compared to published literature; samples of highest concentration was close to hospital
Overall Quality Determination			High	

Study Citation:		Upadhyay, N., Sun, Q., Allen, J. O., Westerhoff, P., Herckes, P. (2011). Synthetic musk emissions from wastewater aeration basins. Water Research 45(3):1071-1078.		
HERO ID:		1970730		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	detailed description of sampling methods
	Metric 2:	Analytical Methodology	High	detailed description of analytical methods
	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 POTWs in the Phoenix (AZ) metropolitan area
	Metric 5:	Currency	Medium	Sampling was conducted during December 2008 - February 2009 at Plant A, May 2009 at Plant B, and April2009 at ASU.
	Metric 6:	Spatial and Temporal Variability	High	≥ 10 samples for a single scenario
	Metric 7:	Exposure Scenario	Medium	Sampling waste water plant specific, but is open to ambient air for public exposure.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	good reporting of results
	Metric 9:	Quality Assurance	Low	poor discussion on QA/QC
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	poor discussion on variability and uncertainty
Overall Quality Determination			Medium	

Study Citation:		Lu, Y.,an, Yuan, T.,ao, Yun, S., Wang, W., Kannan, K. (2011). Occurrence of synthetic musks in indoor dust from China and implications for human exposure. Archives of Environmental Contamination and Toxicology 60(1):182-189.		
HERO ID:		2095404		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	no inconsistencies in the reporting of sampling information,
	Metric 2:	Analytical Methodology	High	no inconsistencies in the reporting of analytical information,
	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	China
	Metric 5:	Currency	Medium	July-September 2009
	Metric 6:	Spatial and Temporal Variability	Medium	5-10 samples for a single scenario
	Metric 7:	Exposure Scenario	High	the exposure scenario discussed in the monitored study does represent the exposure scenario of interest for the chemical.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	good presentation of results
	Metric 9:	Quality Assurance	High	good presentation of QA/QC
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	no major flaws identified with uncertainty
Overall Quality Determination			High	

Study Citation:		Reiner, J. L., Wong, C. M., Arcaro, K. F., Kannan, K. (2007). Synthetic musk fragrances in human milk from the United States. Environmental Science & Technology 41(11):3815-3820.		
HERO ID:		2157333		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	sampling methodology discussed; lacking details such as sample storage time while frozen prior to analyses
	Metric 2:	Analytical Methodology	High	methodology well described, includes chemical-specific LOD
	Metric 3:	Biomarker Selection	High	Parent chemical in biological media, likely reflects exposure of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Massachusetts, USA
	Metric 5:	Currency	Medium	2004 sampling
	Metric 6:	Spatial and Temporal Variability	Medium	sampling likely captures variability of target population as evidenced by discussion of similarities of results to previous monitoring studies, however no duplicate samples reported
	Metric 7:	Exposure Scenario	Medium	Unclear if exposure scenario included occupational exposures which were not PECO-relevant (nail/hair salon, etc)
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Fig. 2 = raw data for HHCB
	Metric 9:	Quality Assurance	Medium	Lack of pre-exposure sampling; authors note mothers not instructed to wash hands prior to pumping breast milk so sample contamination from hands is possible.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited discussion of uncertainties, however authors noted timing of sample collection may not have been ideal with respect to exposure as well as potential for sampling contamination by unwashed hands of mothers.
Overall Quality Determination			High	

Study Citation:		Schmid, P., Kohler, M., Gujer, E., Zennegg, M., Lanfranchi, M. (2007). Persistent organic pollutants, brominated flame retardants and synthetic musks in fish from remote alpine lakes in Switzerland. Chemosphere 67(9):S16-S21.		
HERO ID:		2158150		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	sampling fully explained
	Metric 2:	Analytical Methodology	High	detection limit and analytical method described
	Metric 3:	Biomarker Selection	N/A	testing is for parent chemical
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Alpine lakes in Switzerland
	Metric 5:	Currency	Low	August and September 2003
	Metric 6:	Spatial and Temporal Variability	Medium	7 lakes sampled
	Metric 7:	Exposure Scenario	High	exposure scenario discussed for samples
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	raw data and statistical analysis reported
	Metric 9:	Quality Assurance	High	QA/QC issues identified and described
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	insufficient data on variability and uncertainty
Overall Quality Determination			High	

Study Citation:		Fromme, H., Otto, T., Pilz, K., Neugebauer, F. (1999). Levels of synthetic musks; Bromocyclene and PCBs in eel (<i>Anguilla anguilla</i>) and PCBs in sediment samples from some waters of Berlin/Germany. Chemosphere 39(10):1723-1735.		
HERO ID:		2162536		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	samples prepared in accordance with the German Food Monitoring Program
	Metric 2:	Analytical Methodology	Low	GC/ECD; 89% recovery; no LOD or LOQ provided
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	from rivers and lakes in Berlin, Germany
	Metric 5:	Currency	Low	1996
	Metric 6:	Spatial and Temporal Variability	High	122 samples
	Metric 7:	Exposure Scenario	High	the exposure scenario discussed in the monitored study does represent the exposure scenario of interest for the chemical.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	raw data not reported; mean, SD, min and max Tables 4 and 5
	Metric 9:	Quality Assurance	Low	one blank and one reference material along with each group of 10 fish samples; no discussion of QA/QC issues
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	std reported
Overall Quality Determination			Medium	

Study Citation:		Stevens, J. L., Northcott, G. L., Stern, G. A., Tomy, G. T., Jones, K. C. (2003). PAHs, PCBs, PCNs, organochlorine pesticides, synthetic musks, and polychlorinated n-alkanes in U.K. sewage sludge: Survey results and implications. Environmental Science & Technology 37(3):462-467.		
HERO ID:		2163577		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	not a lot of discussion on sampling equipment; does discuss sampling storage and preparation
	Metric 2:	Analytical Methodology	Low	GC; how LOD calculated provided (p.464) but number not provided
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	14 WWTP in UK; further information not provided
	Metric 5:	Currency	Low	date sampled not provided; published 2003
	Metric 6:	Spatial and Temporal Variability	Medium	a 5-L sample collected at each works; 14 WWTP; range represents different catchment sizes and industrial input; no discussion on when samples collected or replicates
	Metric 7:	Exposure Scenario	Medium	Table 1 provides details on WWTP (urban, industrial, domestic); locations (cities) not provided
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	min, max, mean, median for the 14 WWTP sludge; individual data or data by facility not provided; no SI
	Metric 9:	Quality Assurance	Low	in discussion, compared results with recent data; otherwise, QA/QC not presented
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	variability and uncertainty not discussed
Overall Quality Determination			Low	

Study Citation:		Kallenborn, R., Gatermann, R., Nygard, T., Knutzen, J., Schlabach, M. (2001). Synthetic musks in Norwegian marine fish samples collected in the vicinity of densely populated areas. Fresenius Environmental Bulletin 10(11):832-842.		
HERO ID:		2169077		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	sampling fully described
	Metric 2:	Analytical Methodology	Medium	LOQ described, insufficient detail on statistical analysis
	Metric 3:	Biomarker Selection	N/A	study is testing for parent chemical in environmental media
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	harbours of Oslo and Larvik, inner and outer Oslofjord, Grenland fjords and the open coast of Telemark county, Norway
	Metric 5:	Currency	Low	Winter 1997-1998
	Metric 6:	Spatial and Temporal Variability	Low	10 pooled samples; Pooling samples involves mixing several samples together in a "batch".
	Metric 7:	Exposure Scenario	High	samples taken from area of exposure
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	raw data reported
	Metric 9:	Quality Assurance	Medium	Discussed qa/qc in text.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	variability discussed briefly, insufficient detail
Overall Quality Determination			Medium	

Study Citation:		Moon, H., An, Y. R., Park, K. J., Choi, S. G., Moon, D., Choi, M., Choi, H. (2011). Occurrence and accumulation features of polycyclic aromatic hydrocarbons and synthetic musk compounds in finless porpoises (Neophocaena phocaenoides) from Korean coastal waters. Marine Pollution Bulletin 62(9):1963-1968.		
HERO ID:		2177137		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	sampling fully explained
	Metric 2:	Analytical Methodology	High	LOQ/LOD discussed, analytical method described
	Metric 3:	Biomarker Selection	N/A	testing of parent chemical in environmental media
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	South Sea and the Yellow Sea, Korea
	Metric 5:	Currency	Low	May-August 2003
	Metric 6:	Spatial and Temporal Variability	High	52 samples of finless porpoises
	Metric 7:	Exposure Scenario	High	samples found tangled in fishing nets
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	raw data and statistical analyses report
	Metric 9:	Quality Assurance	High	QA/QC issues identified and discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	insufficient reporting on variability and uncertainty
Overall Quality Determination			High	

Study Citation:		Muller, S., Schmid, P., Schlatter, C. (1996). Occurrence of nitro and non-nitro benzenoid musk compounds in human adipose tissue. Chemosphere 33(1):17-28.		
HERO ID:		2177626		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling equipment briefly noted for human adipose sampling. Insufficient information regarding sampling procedures/regime. Sample storage conditions noted for tissue samples but sample storage duration prior to analysis missing. Insufficient information on study site characteristics, although limited demographic characteristics of cadavers reported.
	Metric 2:	Analytical Methodology	Medium	Medium—tissue and water. Analytical method extraction, instrumentation for tissue (GPC), LOD, and recovery % described. Insufficient information on calibration of analytical instrumentation.
	Metric 3:	Biomarker Selection	High	High: Parent chemical in biological media, likely reflects exposure of interest
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Assume cadaver adipose tissue samples from individuals originally residing within Switzerland.
	Metric 5:	Currency	Low	Low—Cadaver tissue samples taken from 15 cadavers with text noting four samples taken in 1983/84 and eleven taken in 1994.
	Metric 6:	Spatial and Temporal Variability	Low	Low—Tissue and water samples. Cadaver tissue samples from 15 cadavers, however samples noted as taken from frozen cadavers in 1983-84 (n=4) and 1994 (n=11), geographic residence of individuals not noted, no replicate sampling conducted, single tissue samples taken from each cadaver.
	Metric 7:	Exposure Scenario	Medium	Medium—Cadaver tissue sampling, as limited demographic information on cadavers (age, sex) reported.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Low—Tissue sampling provides raw concentration data for each cadaver, however supplementary data are not provided and summary statistics within Table 2 are missing most parameters (range, variation in terms of CV or SD) and results not adjusted for demographic parameters collected.
	Metric 9:	Quality Assurance	Medium	Medium—tissue sample analysis briefly noted analysis of procedural blanks and analytical recovery range for chemical of interest.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Insufficient information on characterization of variability in terms of concentration range, SD, etc., key uncertainties and limitations not discussed. Trends in age and sex of cadavers with respect to tissue concentrations, as well as concentration trend over years of sampling, conducted with seemingly visual inspection of Table 2.
Overall Quality Determination			Low	

Study Citation:		Schiavone, A., Kannan, K., Horii, Y., Focardi, S., Corsolini, S. (2009). Occurrence of brominated flame retardants, polycyclic musks, and chlorinated naphthalenes in seal blubber from Antarctica: Comparison to organochlorines. Marine Pollution Bulletin 58(9):1415-1419.		
HERO ID:		2183480		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	took blubber from seal carcasses found dead
	Metric 2:	Analytical Methodology	Medium	LOD in text. Not corrected for recoveries.
	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	Antarctica
	Metric 5:	Currency	Low	2004
	Metric 6:	Spatial and Temporal Variability	Low	4 seal pup carcasses. no replicates
	Metric 7:	Exposure Scenario	High	the exposure scenario discussed in the monitored study does represent the exposure scenario of interest for the chemical.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics Table 2; SD included
	Metric 9:	Quality Assurance	Low	quality not directly discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	variability and uncertainty not discussed
Overall Quality Determination			Low	

Study Citation:		Shek, W. M., Murphy, M. B., Lam, J. C. W., Lam, P. K. S. (2008). Synthetic polycyclic musks in Hong Kong sewage sludge. Chemosphere 71(7):1241-1250.		
HERO ID:		2184061		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology discussed.
	Metric 2:	Analytical Methodology	High	GC-MSD; LOD 0.09 ng/ml
	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	Hong Kong; Fig 1 provides map of studies locations
	Metric 5:	Currency	Medium	August to October 2005
	Metric 6:	Spatial and Temporal Variability	Medium	1 L dewatered sludge collected from each of 10 STW; triplicate sample taken from each STW; 30 samples total
	Metric 7:	Exposure Scenario	High	the exposure scenario discussed in the monitored study does represent the exposure scenario of interest for the chemical.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	DF, mean, SD, range provided (Table 1)
	Metric 9:	Quality Assurance	High	recovery rate 101%; compares to other published results; blanks with every set of 5 samples; Section 2.6
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	std provided; compares to other published results; discusses variability
Overall Quality Determination			High	

Study Citation:		Wan, Y., Wei, Q., Hu, J., Jin, X., Zhang, Z., Zhen, H., Liu, J. (2007). Levels, tissue distribution, and age-related accumulation of synthetic musk fragrances in Chinese sturgeon (<i>Acipenser sinensis</i>): Comparison to organochlorines. Environmental Science & Technology 41(2):424-430.		
HERO ID:		2187423		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology well described
	Metric 2:	Analytical Methodology	Medium	DL in text; More details should be in the SI; LOD described.
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China Yangtze River
	Metric 5:	Currency	Low	2003-2005
	Metric 6:	Spatial and Temporal Variability	Medium	n=1 to 11 depending on tissue (13 fish collected)
	Metric 7:	Exposure Scenario	High	the exposure scenario discussed in the monitored study does represent the exposure scenario of interest for the chemical.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary data in Table 2; min, max, mean, SD
	Metric 9:	Quality Assurance	Medium	recovery reported, but unclear if data were corrected for recovery
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	not discussed
Overall Quality Determination			Medium	

Study Citation:		Xie, Z., Ebinghaus, R., Temme, C., Heemken, O., Ruck, W. (2007). Air-sea exchange fluxes of synthetic polycyclic musks in the North Sea and the Arctic. Environmental Science & Technology 41(16):5654-5659.		
HERO ID:		2188577		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Experimental Section and further details in SI
	Metric 2:	Analytical Methodology	High	GS-MS; LOD was 0.1 pg; MDLS was 0.9 ng/sample or 0.6 ng/sample (p. 5655)
	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	air and seawater in Arctic and North Sea; rural air of northern Germany
	Metric 5:	Currency	Low	Germany sampling Nov 2004 and Feb 2006; Arctic June to Aug 2004; North Sea July 2005
	Metric 6:	Spatial and Temporal Variability	Medium	North Sea (10 sample locations); Arctic (6 sample locations); Germany (6 sample locations) - Figures 1-6; Table 1 has 24 samples; further detail in SI
	Metric 7:	Exposure Scenario	High	simultaneous air and seawater samples; air samples in a rural forest area 37 km east of major city of Hamburg, Germany
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	concentrations in Figures 1, 2, and 3; for detail see SI; Table 1 concentration per sample for North Sea
	Metric 9:	Quality Assurance	High	mean recoveries were 113, 84, 114; field blanks prepared
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	std added for duplicated samples; compared to published data
Overall Quality Determination			High	

Study Citation:		Zehringer, M., Herrmann, A. (2001). Analysis of polychlorinated biphenyls, pyrethroid insecticides and fragrances in human milk using a laminar cup liner in the GC injector. European Food Research and Technology 212(2):247-251.		
HERO ID:		2189240		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling procedures, equipment, storage conditions described. Insufficient information on storage duration prior to analysis. Authors note area of residence information (study site) collected within questionnaire.
	Metric 2:	Analytical Methodology	Medium	Extraction, analytical instrumentation (GC-MSD), recovery, chemical-specific LOD detailed. Insufficient information on instrument calibration.
	Metric 3:	Biomarker Selection	N/A	N/A: Parent chemical of interest sampled within human milk.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Most (55%) of samples noted as provided by Swiss women. Authors note Mothers from eleven countries contributed to the investigation, although also note that their milk samples were from mothers living around the city of Basle, Switzerland as part of regular sampling program conducted by the State Laboratory of Basle City. It seems the eleven countries of origin referred to ethnicity rather than actual location of residence at time of sampling.
	Metric 5:	Currency	Low	Sampling conducted in winter of 1998-1999.
	Metric 6:	Spatial and Temporal Variability	Medium	Authors note some evidence of duplicate sampling as 53 milk samples were collected from 29 mothers, single milk samples from remaining mothers.
	Metric 7:	Exposure Scenario	Low	Authors note information on demographics, occupation, area of residence and use of pesticides and cosmetics, but do not present data on occupation, etc for population sampled. Inconsistencies in description of sampling location as sampling from eleven countries, yet also noted as around the region of Basle, Switzerland.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Mean, median concentrations with range reported, no raw data or measures of variation.
	Metric 9:	Quality Assurance	Medium	Laboratory recoveries noted, however insufficient information on blank or control samples, storage recoveries, baseline or pre-exposure sampling.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Characterization of variability limited to comparison of reported concentrations with previous studies, key uncertainties or limitations such as the lack of correlation between measured milk concentrations and self-reported use of cosmetics, fat content of milk sample.
Overall Quality Determination			Medium	

Study Citation:		Zhang, X., Xu, Q., Man, S., Zeng, X., Yu, Y., Pang, Y., Sheng, G., Fu, J. (2013). Tissue concentrations, bioaccumulation, and biomagnification of synthetic musks in freshwater fish from Taihu Lake, China. Environmental Science and Pollution Research 20(1):311-322.		
HERO ID:		2189417		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling fully explained
	Metric 2:	Analytical Methodology	Medium	limit of detection described, insufficient detail on analytical method
	Metric 3:	Biomarker Selection	N/A	testing parent chemical in environmental media
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Meiliang Bay, Gonghu Lake, and Suzhou in Taihu Lake, China
	Metric 5:	Currency	Medium	September 2007
	Metric 6:	Spatial and Temporal Variability	High	168 samples of 24 species
	Metric 7:	Exposure Scenario	High	samples from 3 locations
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	limits, and raw data reported
	Metric 9:	Quality Assurance	High	QA/QC methods discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	variability and uncertainty discussed and reported
Overall Quality Determination			High	

Study Citation:		Subedi, B., Du, B., Chambliss, C. K., Koschorreck, J.,an, Ruedel, H., Quack, M., Brooks, B. W., Usenko, S. (2012). Occurrence of Pharmaceuticals and Personal Care Products in German Fish Tissue: A National Study. Environmental Science & Technology 46(16):9047-9054.		
HERO ID:		2214896		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	German Environment Specimen Bank (GESB): River fish sampled annually at same locations and archived; detailed descriptions available in Supplemental Information (and in Boehmer et al. 2004 and Wenzel et al. 2004).
	Metric 2:	Analytical Methodology	High	Isotope dilution LC-MS/MS; MDL 1.6 ng/g wet weight.
	Metric 3:	Biomarker Selection	Medium	Lipid-normalized concentrations of HHCB in bream (<i>Abramis brama</i>) homogenized fish fillets.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Along Rhine, Danube, and Elbe Rivers, Germany; EU, and one lake reference site.
	Metric 5:	Currency	Medium	2007-2008
	Metric 6:	Spatial and Temporal Variability	Medium	Sampling of fish at 13 river locations and 1 lake reference site conducted annually; 2 years of samples analyzed for current study; 20 bream of both sexes 8-12 years of age from each location; subsamples of pooled fillet samples analyzed; sample sizes specified in Supplemental Information; measure of variance presumably SE of mean.
	Metric 7:	Exposure Scenario	High	Fish captured downstream from WWTP and standard fish biomonitoring stations; species in middle of limnetic food chain; possibly consumed by humans.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Mean and variance reported by sampling location in text (not in tables). Unclear of more data available in Supplemental Information from http://pubs.acs.org (free).
	Metric 9:	Quality Assurance	Medium	High quality; however, details in Supplemental Information.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Mean and SE (or SD, not specified) reported by location; results compared with other studies and other locations. Developed empirical regression equation for HHCB concentration with proximity of site to WWTP (PSL) and river mean annual flow (MAF). No HHCB found in reference lake.
Overall Quality Determination			High	

Study Citation:		Shin, H. M., Mckone, T. E., Nishioka, M. G., Fallin, M. D., Croen, L. A., Hertz-Picciotto, I., Newschaffer, C. J., Bennett, D. H. (2014). Determining source strength of semivolatile organic compounds using measured concentrations in indoor dust. Indoor Air 24(3):260-271.		
HERO ID:		2215665		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling method was discussed in detail, including sampling procedure, storage conditions, and matrix characterization. Information regarding duration of sample storage prior to analysis was lacking.
	Metric 2:	Analytical Methodology	High	The analytical method (GC/MS) was described in terms of instrumentation, extraction, calibration, and recovery, with limits of detection reported within Table S1.
	Metric 3:	Biomarker Selection	N/A	This study sampled for chemicals of interest within indoor dust.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected from residences in Northern California, Southeast Pennsylvania, and Northeast Maryland.
	Metric 5:	Currency	Medium	Samples were collected during 2009 and 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	A total of 30 indoor surface dust samples, one from a single main living room of each house, were collected in an area described as the equivalent of the entire floor surface area of participating homes within Northern California, Southeast Pennsylvania, and Northeast Maryland between 2009 and 2010. Replicate sampling was not detailed.
	Metric 7:	Exposure Scenario	High	The exposure scenario was described and was highly relevant (indoor air) and the study used fugacity-based modeling to predict the emission, fate and movement of chemicals in the indoor environment from various consumer product exposure sources. Use of exposure controls was not detailed.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No individual raw data points were provided. Statistical summary measures included mean, standard deviation, median and maximum concentrations as well as frequency of detection in Table S1.
	Metric 9:	Quality Assurance	Medium	Quality assurance measures were applied and described in robust details. Solvent method blanks were used and recoveries were reported. Baseline, pre-exposure sampling was not conducted.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	The study had a robust discussion of uncertainty and compared results to results of other studies. The study also characterized limitations in details.
Overall Quality Determination			High	

Study Citation:		Blanchard, O., Glorennec, P., Mercier, F., Bonvallot, N., Chevrier, C., Ramalho, O., Mandin, C., Le Bot, B. (2014). Semivolatile organic compounds in indoor air and settled dust in 30 French dwellings. Environmental Science & Technology 48(7):3959-3969.		
HERO ID:		2241683		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling is well described on page 3960 and includes dust and air sampling procedures. This is also presented in Table 2.
	Metric 2:	Analytical Methodology	High	The analytical procedures are presented sufficiently on page 3960.
	Metric 3:	Biomarker Selection	N/A	Biomarkers were not identified or relevant for this study.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study location is Brittany, Western France.
	Metric 5:	Currency	Medium	Sampling was done in 2011.
	Metric 6:	Spatial and Temporal Variability	High	Generally, there were at least 10 samples per scenario; n=29.
	Metric 7:	Exposure Scenario	High	The exposure scenario studied is relevant to TSCA-related exposure scenarios.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Results are well presented and discussed.
	Metric 9:	Quality Assurance	High	Replicates and recovery sampling were considered.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Relative standard deviations were considered in this study.
Overall Quality Determination			High	

Study Citation:		Mercier, F., Gilles, E., Saramito, G., Glorennec, P., Le Bot, B. (2014). A multi-residue method for the simultaneous analysis in indoor dust of several classes of semi-volatile organic compounds by pressurized liquid extraction and gas chromatography/tandem mass spectrometry. Journal of Chromatography A 1336:101-111.		
HERO ID:		2298081		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Dust collected from household vacuum bags, sieved before sealed/frozen storage.
	Metric 2:	Analytical Methodology	High	Analysis via PLE-GC/MS/MS explained in detail with LOQ, matrix interference, etc.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	France, Brittany.
	Metric 5:	Currency	Medium	September 2009 through October 2012.
	Metric 6:	Spatial and Temporal Variability	Medium	N = 7 vacuum bags, 1 per dwelling.
	Metric 7:	Exposure Scenario	High	Indoor dust from family dwellings.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data reported (n = 7).
	Metric 9:	Quality Assurance	High	Extensive QA to evaluate analytic methods; used SRM from US NIST; 3-level quantitative calibration.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Indoor dust, 1 analytic measure/dwelling, n = 7 dwellings; focus on performance of GC/MS/MS methods.
Overall Quality Determination			High	

Study Citation:		Villa, S., Vighi, M., Finizio, A. (2014). Theoretical and experimental evidences of medium range atmospheric transport processes of polycyclic musk fragrances. Science of the Total Environment 481(1):27-34.		
HERO ID:		2541915		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	snow and water samples were filtered; sampling equipment and procedure discussed in 2.1 and 2.2
	Metric 2:	Analytical Methodology	High	GC-MS in SIM; LOQ 5 pg/L for water and 0.07 ng/g for suspended solids; six recoveries
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Figure 1 shows location of sampling site on the Forni Glacier; near Forni Dam in Northern Italy
	Metric 5:	Currency	Medium	summer and later summer/autumn 2012
	Metric 6:	Spatial and Temporal Variability	Medium	snow = 4 replicates; water samples = 7 replicates; 1 site and two different monitoring campaigns; snow one day in May; water collected on two different dates (one day in May and the other in October)
	Metric 7:	Exposure Scenario	High	sampled area near source of emission; sampling time supported by preceding experiences
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	snow - Table 2; Section 3.2; mean and range provided; individual data points not provided; text and table results transposed; water samples - Fig 5; Section 3.4; mean and std; suspended solids below LOD
	Metric 9:	Quality Assurance	High	Section 2.3 QC; recoveries water 93% and suspended solids 80%; field blanks generated
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	discussion of differences in Section 3.4; compared results to published findings
Overall Quality Determination			High	

Study Citation:		Mu, L., Wen, J. P. (2013). Spatial distribution characteristics of polycyclic musks as a chemical marker in river water and sediment compared with other typical pollutants. Water Science and Technology 67(6):1173-1180.		
HERO ID:		2553805		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	water samples filtered
	Metric 2:	Analytical Methodology	High	SPE,LOQ 0.1 mg/kg in sediment and 0.15 ug/L in water; recoveries
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Haihe River in China; Figure 1
	Metric 5:	Currency	Medium	Nov 2011 and Jan 2012
	Metric 6:	Spatial and Temporal Variability	High	36 water and 36 sediment samples by duplicate sampling at nine sites
	Metric 7:	Exposure Scenario	High	river polluted by industrial, domestic, and ag effluents in recent years
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	range, concentration by sample site, std - p. 1175; Fig 2
	Metric 9:	Quality Assurance	High	recoveries = 85% sediment; 92% water
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	compared to other published data
Overall Quality Determination			High	

Study Citation:		Del Río, H., Suárez, J., Puertas, J., Ures, P. (2013). PPCPs wet weather mobilization in a combined sewer in NW Spain. Science of the Total Environment 449(Elsevier):189-198.		
HERO ID:		2554823		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Explained in document; samples separated into particulate and water phases.
	Metric 2:	Analytical Methodology	High	GC/MS - details described in Supplemental Information.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Spain, aerial map of city provided
	Metric 5:	Currency	Medium	2008, 2009
	Metric 6:	Spatial and Temporal Variability	High	All seasons included; 8 (3-L grab samples) obtained over 1 hour for each of 10 rain events; 48 dry-weather samples (3-L) taken on 6 days covering both weekday and weekend.
	Metric 7:	Exposure Scenario	Medium	Combined sewage overflow (CSO) sampled; receiving waters not.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Event range, mean, median, and SD reported for each day’s 8 samples; some raw data presented graphically; all raw data might be in Supporting Information (SI).
	Metric 9:	Quality Assurance	Medium	LOQ, standard recovery, and other QA information provided in SI.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variation across dry and wet periods and seasons encompassed; temporal variation within rainfall events characterized. One city.
Overall Quality Determination			High	

Study Citation:		Kubwabo, C., Fan, X., Rasmussen, P. E., Wu, F. (2012). Determination of synthetic musk compounds in indoor house dust by gas chromatography-ion trap mass spectrometry. Analytical and Bioanalytical Chemistry 404(2):467-477.		
HERO ID:		2562851		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods, equipment, and storage all reported.
	Metric 2:	Analytical Methodology	Medium	Extraction instrument and methods described, however, method detection limit was reported as a range.
	Metric 3:	Biomarker Selection	N/A	Testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected from Canada.
	Metric 5:	Currency	Low	low score since no sampling date was provided, but the publication date is available
	Metric 6:	Spatial and Temporal Variability	Medium	49 samples taken, no sample replicates reported.
	Metric 7:	Exposure Scenario	High	The study investigated HHCB in house dust that may come from synthetic musks or fragrances, however, there is no indication if HHCB from the samples came from these sources.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported. Summary statistics reported in Table 4.
	Metric 9:	Quality Assurance	Low	QA/QC not explicitly reported but can be inferred from methodologies. Recoveries reported from 54-117%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variability and uncertainty not reported. However, different houses sampled to give a variability to different environments sampled.
Overall Quality Determination			Medium	

Study Citation:		Moldovan, Z., Chira, R., Alder, A. C. (2009). Environmental exposure of pharmaceuticals and musk fragrances in the Somes River before and after upgrading the municipal wastewater treatment plant Cluj-Napoca, Romania. Environmental Science and Pollution Research 16(1 p.46-54):46-54.		
HERO ID:		2598189		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling site and procedure described. However, equipment and storage of samples not reported.
	Metric 2:	Analytical Methodology	High	GC/MS; LOQ 30 ng/L for first campaign and 10ng/L for second
	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	three collection sites along Somes River near WWTP Cluj-Napoca in Transylvania, Romania
	Metric 5:	Currency	Medium	first river sampling April 2001; second September 2006
	Metric 6:	Spatial and Temporal Variability	Low	two sampling campaigns (before and after WWTP upgrade); 3 sites along river; samples combined into one sample
	Metric 7:	Exposure Scenario	High	Somes River Watershed populated by 1,800,00 inhabitants; most important WWTPs in area
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	average concentration in surface water per site before and after upgrade of WWTP (Table 2); no other stats provided; individual data not provided; no SI
	Metric 9:	Quality Assurance	High	recoveries ranged from 55-110%; results were corrected; calibration curves; response signals; overall precision (p. S49)
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability accounted for in sampling different locations in river. Uncertainties not reported.
Overall Quality Determination			Medium	

Study Citation:		Ramirez, N., Maria Marce, R., Borrull, F. (2010). Development of a thermal desorption-gas chromatography-mass spectrometry method for determining personal care products in air. Journal of Chromatography A 1217(26):4430-4438.		
HERO ID:		2629713		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods and equipment reported. Storage conditions and indoor environments sampled listed.
	Metric 2:	Analytical Methodology	High	Analytical instrument and methods reported. LOD of detection reported for HHCB.
	Metric 3:	Biomarker Selection	N/A	The study testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Location is not specified but implied in Spain due to publication.
	Metric 5:	Currency	Low	sampling date not reported but publication date is available
	Metric 6:	Spatial and Temporal Variability	Low	Seven samples were taken with no replicates.
	Metric 7:	Exposure Scenario	Medium	The samples were taken from environments where HHCB products could be used, but there is no clear connection between the products and chemical concentration in environment.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	only raw data is available; no measure of variation reported
	Metric 9:	Quality Assurance	High	QA/QC not explicitly reported but can be inferred from methodology. Recoveries above 90%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability accounted for in different environments sampled. Uncertainties not reported.
Overall Quality Determination			Medium	

Study Citation:		Ramirez, N., Maria Marce, R., Borrull, F. (2011). Development of a stir bar sorptive extraction and thermal desorption-gas chromatography-mass spectrometry method for determining synthetic musks in water samples. Journal of Chromatography A 1218(1):156-161.		
HERO ID:		2712965		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Samples of effluent from WWTP and reverse osmosis (RO) facility and water from Ebro River.
	Metric 2:	Analytical Methodology	High	Method development and validation; SBSE coupled with conventional TD/GC/MS;
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Spain
	Metric 5:	Currency	Low	Not specified; probably between 1999 and 2011.
	Metric 6:	Spatial and Temporal Variability	Low	3 samples from 4 representative water types, including 2 WWTP, one reverse osmosis plant, and river.
	Metric 7:	Exposure Scenario	Low	Concentration in effluents from wastewater treatment plant, reverse osmosis treatment, and in river water; not measures from direct exposure media (e.g., drinking water).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Reported only the range of concentrations measured (from triplicate analysis of 4 samples).
	Metric 9:	Quality Assurance	High	Development and validation of analytic method.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Samples taken for method validation using real world media, not for characterization of chemical over time or space in environmental media.
Overall Quality Determination			Medium	

Study Citation:		Dallongeville, A., Costet, N., Zmirou-Navier, D., Le Bot, B., Chevrier, C., Deguen, S., Annesi-Maesano, I., Blanchard, O. (2016). Volatile and semi-volatile organic compounds of respiratory health relevance in French dwellings. Indoor Air 26(3):426-438.		
HERO ID:		2918731		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Supporting Information available in online version of article and in Mercier et al. (2014).
	Metric 2:	Analytical Methodology	High	PLE extraction; GC/MS (Mercier et al. 2014), calibration.
	Metric 3:	Biomarker Selection	N/A	Paper measures concentration of parent compound in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	France, western; Brittany.
	Metric 5:	Currency	Medium	September 2012 to October 2013.
	Metric 6:	Spatial and Temporal Variability	High	150 homes; 81 sampled cold season; 69 sampled hot season. Living room air continuously collected over 5 days for total of 14 m3 per dwelling.
	Metric 7:	Exposure Scenario	High	Indoor air; living room; single family homes with children.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Reported n, LOQ, detection frequency, mean, median, max, min, and 10th and 90th percentiles.
	Metric 9:	Quality Assurance	High	Field blanks, lab blanks, five calibration solutions per compound.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Limitation of one 5-day sampling event per dwelling discussed; influence of other factors evaluated.
Overall Quality Determination			High	

Study Citation:		Calderón-Preciado, D., Matamoros, V., Bayona, J. M. (2011). Occurrence and potential crop uptake of emerging contaminants and related compounds in an agricultural irrigation network. Science of the Total Environment 412-413:14-19.		
HERO ID:		2919589		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The study explains sampling procedures, materials, sites, and storage conditions.
	Metric 2:	Analytical Methodology	Medium	The study explains the analytical method. The LOD is reported as a range.
	Metric 3:	Biomarker Selection	N/A	The parent chemical was measured in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Spain.
	Metric 5:	Currency	Medium	Samples collected in the summer of 2008 and 2009.
	Metric 6:	Spatial and Temporal Variability	Medium	A total of 8 samples were collected.
	Metric 7:	Exposure Scenario	Medium	The study evaluates the concentrations of the parent chemical in surface water from an agricultural area.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The raw data is not reported. Table 1 reports mean and SD.
	Metric 9:	Quality Assurance	Low	There is limited information regarding the QA/QC procedures.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study reports variability in terms of SD and some limitations mentioned in the conclusions.
Overall Quality Determination			Medium	

Study Citation:		Luigi, V., Giuseppe, M., Claudio, R. (2015). 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:		Patiño, R., Vanlandeghem, M. M., Goodbred, S. L., Orsak, E., Jenkins, J. A., Echols, K., Rosen, M. R., Torres, L. (2015). Novel associations between contaminant body burdens and biomarkers of reproductive condition in male Common Carp along multiple gradients of contaminant exposure in Lake Mead National Recreation Area, USA. General and Comparative Endocrinology 219:112-124.		
HERO ID:		2920040		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	sampling fully explained
	Metric 2:	Analytical Methodology	Medium	LOD reported in range, analytical method described
	Metric 3:	Biomarker Selection	N/A	testing parent chemical
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Lake Mead National Recreation Area, Nevada and Arizona, USA
	Metric 5:	Currency	Medium	March 2007
	Metric 6:	Spatial and Temporal Variability	High	4 study sites, 11-16 fish samples taken at each
	Metric 7:	Exposure Scenario	High	fish samples from different locations on the lake
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	statistical analysis report, no raw data reported
	Metric 9:	Quality Assurance	Low	No QA / QC discussion
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	variability and uncertainty discussed throughout text
Overall Quality Determination			High	

Study Citation:		Zhang, X. L., Jing, Y., Ma, L., Zhou, J., Fang, X. M., Zhang, X. Y., Yu, Y. X. (2015). Occurrence and transport of synthetic musks in paired maternal blood, umbilical cord blood, and breast milk. International Journal of Hygiene and Environmental Health 218(1):99-106.		
HERO ID:		2927006		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methodology, procedures for hospital delivery maternal blood, delivery cord blood, and breast milk samples taken within five days of delivery briefly presented. Insufficient information on sampling equipment, details on manual or pump breast milk sampling and whether mother was instructed to refrain from using lotions, etc while taking sample, sample storage (frozen breast milk, cord blood and maternal blood samples noted in extraction section) details, and sample storage duration prior to chemical analysis.
	Metric 2:	Analytical Methodology	Medium	Details on extraction method, analytical instrumentation (GC/MS), calibration curves, and recovery samples provided. Detection limits presented as ranges. Authors note further details on extraction methodology within referenced previous work (Zhang et al., 2011), and note data were processed blind.
	Metric 3:	Biomarker Selection	N/A	N/A: Sampling for parent chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Participants recruited from urban and rural hospitals in Shanghai, China.
	Metric 5:	Currency	Medium	Table 2 notes sampling time as 2007.
	Metric 6:	Spatial and Temporal Variability	Medium	Lack of duplicate samples for all media (although not specifically stated, assumed single samples of breast milk taken within five days of delivery as well as delivery maternal and cord blood single spot sampling), non-statistical sampling approach. Sample sizes reported as > 20 for each sampling media overall, however subgroup analysis of urban/rural range from n=9-21.
	Metric 7:	Exposure Scenario	Medium	Use of laboratory but not field/exposure blanks. Use of questionnaire to record population demographics as well as smoking and occupational data, and participants who may have had occupational exposure noted as excluded.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported nor indicated to be within SI or referenced articles. Statistical summary of data in terms of median, variation (range), number of samples, frequency of detection, year of sampling and urban/rural location provided. Authors note tests for outliers within discussion. Lipid-adjustment reported for blood samples.
	Metric 9:	Quality Assurance	Medium	Authors report use of laboratory procedural but not field/exposure blanks or baseline/pre-exposure sampling. Laboratory recoveries, and QA/QC lab protocol described as use of personal care and cleaning products prohibited in the laboratory to avoid sample contamination during preparation and analysis.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variability in terms of range of concentrations and distribution pattern analysis within urban/rural areas presented with extensive discussion of potential sources of contaminants, factors influencing musk concentrations, possible transfer mechanisms of musks as well as consistencies/inconsistencies of results in comparison with previous studies within China and multiple other geographic locations.
Overall Quality Determination			Medium	

Study Citation:		Cunha, S. C., Fernandes, J. O., Vallecillos, L., Cano-Sancho, G., Domingo, J. L., Pocurull, E., Borrull, F., Maulvault, A. L., Ferrari, F., Fernandez-Tejedor, M., Van den Heuvel, F., Kotterman, M. (2015). Co-occurrence of musk fragrances and UV-filters in seafood and macroalgae collected in European hotspots. Environmental Research 143(Pt B):65-71.		
HERO ID:		3021560		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Samples location and media were discussed. Methods and storage conditions also reported.
	Metric 2:	Analytical Methodology	High	Analytical instrument and methods described. MDL reported.
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study conducted in different parts of Europe.
	Metric 5:	Currency	Medium	Study conducted in 2013.
	Metric 6:	Spatial and Temporal Variability	Medium	10-100 samples taken depending on the species and location. Replicate samples not reported.
	Metric 7:	Exposure Scenario	Medium	Different species and locations were sampled, giving a representation of the chemical spatially. However, it is unclear of the source of the exposures.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics reported in Table 6. Raw data not reported.
	Metric 9:	Quality Assurance	Medium	QA/QC not explicitly reported but can be inferred by the methods. Recoveries reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability accounted for in different species and locations sampled. Key uncertainties and limitations were not discussed.
Overall Quality Determination			Medium	

Study Citation:		Reinstorf, F., Strauch, G., Schirmer, K., Gläser, H. R., Möder, M., Wennrich, R., Osenbrück, K., Schirmer, M. (2008). Mass fluxes and spatial trends of xenobiotics in the waters of the city of Halle, Germany. Environmental Pollution 152(2):452-460.		
HERO ID:		3055263		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	1-liter samples, dates (6) reported. Handling and transport of samples not described.
	Metric 2:	Analytical Methodology	Medium	SPE, GC/MS; LOD, % recovery, triplicate analysis.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	River Saale, City of Halle, Germany; map provided.
	Metric 5:	Currency	Low	2002 to 2005
	Metric 6:	Spatial and Temporal Variability	Medium	Sampling on 6 days in winter and summer. Locations: 8 river and 8 groundwater (16 aquifers in city) along river’s flow though the city.
	Metric 7:	Exposure Scenario	Medium	Concentration in SW and GW; not in drinking water.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Mean concentration reported by location; no other descriptors.
	Metric 9:	Quality Assurance	Low	Not well described.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	No measures of variance; compared surface water concentrations with estimated max flux (based on river flow) and discussed uncertainties.
Overall Quality Determination			Medium	

Study Citation:		Ros, O., Izaguirre, J. K., Olivares, M., Bizarro, C., Ortiz-Zarragoitia, M., Cajaraville, M. P., Etxebarria, N., Prieto, A., Vallejo, A. (2015). Determination of endocrine disrupting compounds and their metabolites in fish bile. Science of the Total Environment 536:261-267.		
HERO ID:		3071092		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sample collection is described in Section 2.2.1.
	Metric 2:	Analytical Methodology	High	The samples were analyzed by gas-chromatography–mass spectrometry (GC–MS), though the polar fraction required a previous derivatization with O-bis (trimethylsilyl) trifluoroacetamide. LOD discussed.
	Metric 3:	Biomarker Selection	Medium	These values indicate that fish bile is suitable for biomonitoringpurposes. Finally, the results might indicate a relationship between the analyte concentration in water samples with the number of intersex fish, as the case of Gernika, but no clear relation has been observed between the intersex condition and the analytes in the fish bile. Deeper studies have to be performed in this sense to get a firmly conclusion.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Basque coast.
	Metric 5:	Currency	Medium	May–June 2012
	Metric 6:	Spatial and Temporal Variability	Medium	While there were 12-30 samples, there were no replicates reported.
	Metric 7:	Exposure Scenario	High	The exposure scenario assessed may be useful in a TSCA aquatic exposure assessment or potential fish ingestion exposures.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Results are sufficiently reposted and described.
	Metric 9:	Quality Assurance	High	The study reported recovery and reproducibility.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some discussion of variability is provided (section 3.3, table 1).
Overall Quality Determination			High	

Study Citation:		Rüdel, H., Böhmer, W., Schröter-Kermani, C. (2006). Retrospective monitoring of synthetic musk compounds in aquatic biota from German rivers and coastal areas. Journal of Environmental Monitoring 8(8):812-823.		
HERO ID:		3113340		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods and equipment are described and referenced for additional information. Sampling sites and storage reported.
	Metric 2:	Analytical Methodology	High	LOQs are given in the result tables.
	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 collected in Germany.
	Metric 5:	Currency	Low	Samples collected from 1986 up to 2000.
	Metric 6:	Spatial and Temporal Variability	Medium	Up to 9 samples in each site. No replicates reported.
	Metric 7:	Exposure Scenario	High	Mussel and fish samples were taken from rivers. The study mentions that fragrances are most likely the source of the contamination.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data reported. Summary statistics not reported.
	Metric 9:	Quality Assurance	High	QA/QC not reported, but can be inferred from the methods. Recoveries were above 83%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Uncertainties are not reported. Variability accounted for by different locations and years sampled.
Overall Quality Determination			High	

Study Citation:		Lu, B., Feng, Y., Gao, P., Zhang, Z., Lin, N. (2015). Distribution and fate of synthetic musks in the Songhua River, Northeastern China: influence of environmental variables. Environmental Science and Pollution Research 22(12):9090-9099.		
HERO ID:		3155347		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	detailed sampling program in SI; EWI method employed
	Metric 2:	Analytical Methodology	High	GC–MS in SIM mode; detailed extraction and analytical info presented in SI; LOD for water 2 ng/L; LOQ for sediment 0.5 ng/g
	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	third largest river in China, Songhua River
	Metric 5:	Currency	Medium	12 months 2011-2012
	Metric 6:	Spatial and Temporal Variability	High	9 sampling sites; 20 auxiliary sites; 72 water and 52 sediment samples; sampled over 12 months period
	Metric 7:	Exposure Scenario	High	Water and sediment samples taken from rivers. The study mentions synthetic musk as potential source of contamination.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Table 1 - range and DF; concentration details listed in SI
	Metric 9:	Quality Assurance	High	sample concentrations corrected; blanks, recoveries, and deviations were with acceptable ranges as detailed in SI
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability accounted for by different locations tested. Limitations not reported.
Overall Quality Determination			High	

Study Citation:		Raffy, G., Mercier, F., Blanchard, O., Derbez, M., Dassonville, C., Bonvallot, N., Glorennec, P., Le Bot, B. (2016). Semi-volatile organic compounds in the air and dust of 30 French schools: A pilot study. Indoor Air 27(1):114-127.		
HERO ID:		3229681		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Air sampling described; methods for dust sampling described in SI and in Blanchard et al. (2014).
	Metric 2:	Analytical Methodology	High	Details provided in SI, Mercier et al. (2014), and Blanchard et al. (2014). PLE and GC/MS; 5-level calibration; LOQs; field and lab blanks, and QA samples and recoveries.
	Metric 3:	Biomarker Selection	N/A	Air and dust sampling
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Brittany, France
	Metric 5:	Currency	Medium	2009 to 2010
	Metric 6:	Spatial and Temporal Variability	Medium	33 schools, 3 rooms per school, Air: single 4.5-day continuous sample/room, 1 field blank/school; Dust 1 vacuum per room and 3 damp wipes per room.
	Metric 7:	Exposure Scenario	High	School classrooms: air and dust samples.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	5th, 50th, and 95th percentiles (no mean, no variance); N, freq. of detect, LOQ and upper limit of calibration reported.
	Metric 9:	Quality Assurance	High	Well described in text and SI and includes recovery calculation, running blanks and QC samples
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Discussed analytic issues, uncertainties, possible confounding factors, and excluded data. Variation within and across schools not discussed.
Overall Quality Determination			High	

Study Citation:		Mandin, C., Mercier, F., Rarnalho, O., Lucas, J. P., Gilles, E., Blanchard, O., Bonvallot, N., Glorennec, P., Le Bot, B. (2016). Semi-volatile organic compounds in the particulate phase in dwellings: A nationwide survey in France. Atmospheric Environment 136:82-94.		
HERO ID:		3230506		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling is detailed in Section 2.1.
	Metric 2:	Analytical Methodology	Medium	no recovery samples, but analytical method was previously validated
	Metric 3:	Biomarker Selection	N/A	Biomarkers were not assessed nor relevant for this study.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	This study was located in France.
	Metric 5:	Currency	Medium	sampling took place from October 2003 to December 2005
	Metric 6:	Spatial and Temporal Variability	Medium	no replicate samples, but used continuous air sampling methods over a period of one-week
	Metric 7:	Exposure Scenario	Medium	limited characterization of building characteristics and other microenvironmental factors
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	no raw data reported
	Metric 9:	Quality Assurance	Medium	no recovery samples, but used field blank samples; the analytical method was previously validated; no issues were identified
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	no discussion of limitations or data uncertainties
Overall Quality Determination			Medium	

Study Citation:		Laborie, S., Moreau-Guigon, E., Alliot, F., Desportes, A., Oziol, L., Chevreuil, M. (2016). A new analytical protocol for the determination of 62 endocrine-disrupting compounds in indoor air. Talanta 147:132-141.		
HERO ID:		3230514		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling procedure, matrix characterization were described in detail. The study lacked a few details about storage conditions.
	Metric 2:	Analytical Methodology	High	TBBPA was analyzed by LC/MA; the other chemicals were analyzed by GC/MS. LOD was reported in SI.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	4 indoor environments in Paris.
	Metric 5:	Currency	Medium	2013
	Metric 6:	Spatial and Temporal Variability	Low	The samples came from 4 indoor environments.
	Metric 7:	Exposure Scenario	High	Indoor air
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Average concentrations were reported in Table 5.
	Metric 9:	Quality Assurance	Low	Quality assurance was not directly discussed but assumed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The main discussion on limitation and variability were about the analytical method.
Overall Quality Determination			Medium	

Study Citation:		Zhang, H., Bayen, S., Kelly, B. C. (2015). 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:		Pintado-Herrera, M. G., Wang, C., Lu, J., Chang, Y. P., Chen, W., Li, X., Lara-Martín, P. A. (2016). Distribution, mass inventories, and ecological risk assessment of legacy and emerging contaminants in sediments from the Pearl River Estuary in China. Journal of Hazardous Materials 323(Special Issue Pt A):128-138.		
HERO ID:		3350924		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Section 2.1; detail information in SI
	Metric 2:	Analytical Methodology	High	UPLC-MS/MS and GC-MS/MS; LOD <0.1 - 1 ng/g; detailed 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	Pearl River Estuary, China; large urbanized area
	Metric 5:	Currency	Medium	2012
	Metric 6:	Spatial and Temporal Variability	High	31 sampling stations; sampled in July and December; detailed information provided in SI
	Metric 7:	Exposure Scenario	Medium	The study measures concentration in water, although the study does not mention the source of the chemical.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	min, max, mean, DF - Table 1; individual sampling concentrations provided in SI; variation may be provided in SI
	Metric 9:	Quality Assurance	Low	no QA/QC discussion; may be discussed in SI
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	compares findings to other published data
Overall Quality Determination			High	

Study Citation:		Pintado-Herrera, M. G., González-Mazo, E., Lara-Martín, P. A. (2016). In-cell clean-up pressurized liquid extraction and gas chromatography-tandem mass spectrometry determination of hydrophobic persistent and emerging organic pollutants in coastal sediments. Journal of Chromatography A 1429:107-118.		
HERO ID:		3351112		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling methodology is present, though could benefit from additional detail
	Metric 2:	Analytical Methodology	High	GC-MS/MS; LODs and LOQs in SI;
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	six sites along the Andalusian coast, southern Spain
	Metric 5:	Currency	Medium	2012
	Metric 6:	Spatial and Temporal Variability	Medium	six sites (A1-A6); additional information in SI
	Metric 7:	Exposure Scenario	High	A1-A2 (industrial area); A3-A4 (densely populated with wastewater discharges); A4-A6 (marine protected area)
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 4 provides concentration and SD by site
	Metric 9:	Quality Assurance	Medium	compares findings to published data; recoveries in SI
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	not discussed
Overall Quality Determination			Medium	

Study Citation:		Goodbred, S. L., Patino, R., Torres, L., Echols, K. R., Jenkins, J. A., Rosen, M. R., Orsak, E. (2015). Are endocrine and reproductive biomarkers altered in contaminant-exposed wild male Largemouth Bass (<i>Micropterus salmoides</i>) of Lake Mead, Nevada/Arizona, USA?. General and Comparative Endocrinology 219:125-135.		
HERO ID:		3351209		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is present
	Metric 2:	Analytical Methodology	High	The analytical methodology is present
	Metric 3:	Biomarker Selection	High	Biomarker is in largemouth bass.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Arizona, US
	Metric 5:	Currency	Medium	Sampling 2007-2008
	Metric 6:	Spatial and Temporal Variability	High	≥ 10 samples for a single scenario
	Metric 7:	Exposure Scenario	High	the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data is not presented but summary data is thorough, though incomplete.
	Metric 9:	Quality Assurance	Medium	QA measures discussed but incomplete according to metric criteria.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Not discussed in depth.
Overall Quality Determination			High	

Study Citation:		Fontal, M., van Drooge, B. L., Grimalt, J. O. (2016). A rapid method for the analysis of methyl dihydrojasmonate and galaxolide in indoor and outdoor air particulate matter. Journal of Chromatography A 1447:135-140.		
HERO ID:		3359674		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Well described air sampling accounting for PM by size.
	Metric 2:	Analytical Methodology	High	Derivation with BSTFA:TMCS. PLE or Soxhlet extraction. GC-MS in full-scan electron ionization mode using 2.5% of total filter extracts.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Barcelona, Spain
	Metric 5:	Currency	Medium	2012 to 2013
	Metric 6:	Spatial and Temporal Variability	Medium	24 outdoor urban air samples on different days, warm and cold, at street level and on roof sites; a few samples from other environments (e.g., school, subway).
	Metric 7:	Exposure Scenario	Medium	Outdoor and indoor air; PM measured. Sources not identified.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	For outdoor air samples; raw data presented; additional details provided in SI.
	Metric 9:	Quality Assurance	High	Emphasis on analytic methods development.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Several different environments sampled, but emphasis on testing analytic method, not environmental variation or other non-analytic uncertainties.
Overall Quality Determination			High	

Study Citation:		Kingsbury, J. A., Delzer, G. C., Hopple, J. A. (2008). Anthropogenic organic compounds in source water of nine community water systems that withdraw from streams, 2002-2005. Scientific Investigations Report 2008-5208 :68.		
HERO ID:		3364193		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methods followed standard USGS sampling protocols.
	Metric 2:	Analytical Methodology	Medium	Analyzed using USGS approved analytical methods, but recoveries and LOD were not reported.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed water samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in United States.
	Metric 5:	Currency	Medium	Samples were collected between 2002-2005.
	Metric 6:	Spatial and Temporal Variability	High	n=12-17 source-water samples collected at each site over 12-month period; variety of flow conditions; field blanks and replicates
	Metric 7:	Exposure Scenario	High	The data likely represent relevant exposure scenarios related to stream water collected prior to water treatment and then finished water tested at nine community water systems.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Limited summary statistics were reported DF, n, max concentration reported in appendices.
	Metric 9:	Quality Assurance	High	QA/QC techniques were described in detail, including the use of field blanks and replicates.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability was not characterized. Section "Changes in Concentration" address uncertainties and need for additional information.
Overall Quality Determination			High	

Study Citation:		Ferrario, C., Finizio, A., Villa, S. (2017). Legacy and emerging contaminants in meltwater of three Alpine glaciers. Science of the Total Environment 574(Elsevier):350-357.		
HERO ID:		3457886		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	sampled concentrations in glacial meltwater; all samples collected using aluminium cans; 10L; stored at -20C; water samples filtered
	Metric 2:	Analytical Methodology	Medium	filtered water samples extracted with SPE cartridges; recovery standard added to each sample; GC-MS; LOD 2.1-6.3 pg/L (from SI)
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Italian Alps (Northern Italy): the Lys Glacier in Monte Rosa massif, the Forni Glacier in the Ortles-Cevedale group and the Giogo Alto Glacier in the Palla Bianca-Similaun group (Fig 1)
	Metric 5:	Currency	Medium	2014 (early and late summer)
	Metric 6:	Spatial and Temporal Variability	Low	three Alpine glaciers, each sampled on two separate days (early and late summer); site selection based on differences in geographic positions, meteorological regimes, and land uses;
	Metric 7:	Exposure Scenario	Medium	Forni and Lys Glaciers directly influenced by human activities to a small extend; Giogo Alto Glacier is a skiing area; all glaciers receive air masses coming from both the surrounding agricultural and urbanized areas
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	concentration per glacier per day provided in Table SI-4; minimal statistics provided in Section 3.1.2
	Metric 9:	Quality Assurance	High	Section 2.3; meltwater blanks used; reported values correct by subtracting average blank values; recoveries provided in Table SI-2 (93% for recovery rate in water and 102% in suspended solids)
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	compared concentrations to previous studies which were on the same magnitude (Section 3.1.2)
Overall Quality Determination			High	

Study Citation:		Wang, Q., Kelly, B. C. (2017). Occurrence and distribution of synthetic musks, triclosan and methyl triclosan in a tropical urban catchment: Influence of land-use proximity, rainfall and physicochemical properties. Science of the Total Environment 574:1439-1447.		
HERO ID:		3464285		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Section 2.1
	Metric 2:	Analytical Methodology	Medium	GC-MS/MS; MDLS 0.5-50 pg/L for surface water and 0.3-40 pg/g dw for sediment
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	urban catchment in Singapore
	Metric 5:	Currency	High	surface water (March 2014 and March 2015); sediments (October 2014 and January 2015); SPM from filtered surface water (April, May, June and July 2015)
	Metric 6:	Spatial and Temporal Variability	High	5 sites; 3 samples per site; total samples ranged from 4 to 106
	Metric 7:	Exposure Scenario	High	catchment near highly urbanized area of Singapore with tributaries flowing through industrial and residential areas
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	DF, range, mean, 95% CI provided in Tables 1 and Table 2; not clear if SI has individual sample concentrations
	Metric 9:	Quality Assurance	High	Section 2.3
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	compared findings to other published data
Overall Quality Determination			High	

Study Citation:		Focazio, M. J., Kolpin, D. W., Barnes, K. K., Furlong, E. T., Meyer, M. T., Zaugg, S. D., Barber, L. B., Thurman, M. E. (2008). A national reconnaissance for pharmaceuticals and other organic wastewater contaminants in the United States–II) untreated drinking water sources. Science of the Total Environment 402(2-3):201-216.		
HERO ID:		3559503		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The samples followed standard field protocols from USGS and the methodology was described in the manuscript.
	Metric 2:	Analytical Methodology	Medium	The analytical methods were discussed, including MDL. Recoveries were mentioned but values were not reported.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed water samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	United States; Fig 1 provides locations of sites sampled; Table 1 lists sites sampled.
	Metric 5:	Currency	Low	Samples were collected during the summer 2001.
	Metric 6:	Spatial and Temporal Variability	Low	49 surface water sites (n=73 samples).
	Metric 7:	Exposure Scenario	High	The data closely represent exposure scenarios related to untreated surface water used as sources of drinking water, known or suspected of at least some human and(or) animal wastewater sources in upstream or upgradient areas.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Table 3 provides single max concentration in environment and DF.
	Metric 9:	Quality Assurance	High	QA/QC techniques were discussed, including blanks, spikes, duplicate samples were analyzed to evaluate recovery, reproducibility and lab contamination (p.211); results not corrected for recovery.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability was not characterized. Uncertainties were briefly discussed.
Overall Quality Determination			Medium	

Study Citation:		Combi, T., Pintado-Herrera, M. G., Lara-Martin, P. A., Miserocchi, S., Langone, L., Guerra, R. (2016). Distribution and fate of legacy and emerging contaminants along the Adriatic Sea: A comparative study. Environmental Pollution 218:1055-1064.		
HERO ID:		3983453		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is present
	Metric 2:	Analytical Methodology	Medium	Section 2.3; MDL 0.003 - 0.54 ng/g; more information in SI
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Adriatic sea, southern Europe; Section 2.1
	Metric 5:	Currency	Medium	October 2014
	Metric 6:	Spatial and Temporal Variability	Medium	Fig 1 shows sampling stations which are about >10; sampled in month of October; more information may be in SI
	Metric 7:	Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Table 2 - min, max, mean, SD provided; additional concentration data in SI Tables S1-S3
	Metric 9:	Quality Assurance	Low	recovery ranged from 70-100%
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	compared to published data
Overall Quality Determination			Medium	

Study Citation:		Aguirre-Rubí, J. R., Luna-Acosta, A., Etxebarría, N., Soto, M., Espinoza, F., Ahrens, M. J., Marigómez, I. (2017). Chemical contamination assessment in mangrove-lined Caribbean coastal systems using the oyster <i>Crassostrea rhizophorae</i> as biomonitor species. Environmental Science and Pollution Research 25(14):13396-13415.		
HERO ID:		3984528		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Study sites were described and indicated with a map. Few details were provided about sampling methods.
	Metric 2:	Analytical Methodology	Medium	LOD in table 6. Instrumentation is reported. Replicate samples were mentioned but it is unclear if replicates were taken for HHCB.
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Columbia
	Metric 5:	Currency	Medium	October 2012 and March 2013
	Metric 6:	Spatial and Temporal Variability	High	n = 25 per sampling site (15 sites)
	Metric 7:	Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Results are reported in Table 3 (negative data) and Table 6. Error bars are not shown on the bar graphs in Figure 3.
	Metric 9:	Quality Assurance	Low	Quality Assurance was not directly discussed. Controls are not discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The study “took into account the uncertainty of each methodfrom their validation step and the experimental uncertaintyof replicate samples whenever they were feasible.” Otherwise variability and uncertainty were not discussed.
Overall Quality Determination			Medium	

Study Citation:		Gundersen, D. T., Zeug, S. C., Bringolf, R. B., Merz, J., Jackson, Z., Webb, M. A. H. (2017). Tissue Contaminant Burdens in San Francisco Estuary White Sturgeon (Acipenser transmontanus): Implications for Population Recovery. Archives of Environmental Contamination and Toxicology 73(2):334-347.		
HERO ID:		3984543		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	White sturgeon harvested by anglers participating in derbies. The potential biases from this method of sampling were not discussed.
	Metric 2:	Analytical Methodology	Low	Although minimum quantifiable concentration (MQC) is discussed, it is not presented for galaxolide.
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	San Francisco, CA, US
	Metric 5:	Currency	Medium	Between October 2012 and February 2014
	Metric 6:	Spatial and Temporal Variability	High	55 sturgeon, 10% analyzed by duplicate
	Metric 7:	Exposure Scenario	Medium	dietary exposure is indicated, which is appropriate, but the tissues collected (liver and gonad) are not the most likely consumed tissue.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	summary data
	Metric 9:	Quality Assurance	High	QA discussed: blanks, spiked controls, duplicates, recoveries,
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	uncertainties not explicitly discussed.
Overall Quality Determination			Medium	

Study Citation:		Necibi, M., Lancelleur, L., Mzoughi, N., Monperrus, M. (2016). Determination of Synthetic Musks in Surface Sediment from the Bizerte Lagoon by QuEChERS Extraction Followed by GC-MS. Bulletin of Environmental Contamination and Toxicology 97(5):659-669.		
HERO ID:		3985839		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is present
	Metric 2:	Analytical Methodology	High	QuEChERS followedby GC-MS; LOD, LOQ and MDL table 2
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Bizerte Lagoon, Northern most part of Tunisia
	Metric 5:	Currency	Medium	July 2013
	Metric 6:	Spatial and Temporal Variability	High	13 samples stations
	Metric 7:	Exposure Scenario	Medium	selection of sampling stations based on different criteria related to geomorphology of lagoon, hydrologic regime, and localization of urban and industrial discharges; while the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 4 - concentrations in sediments per sampling site
	Metric 9:	Quality Assurance	High	recoveries reported in Table 3
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	compares results to other published data; Table 5 and P. 668
Overall Quality Determination			High	

Study Citation:		Blum, K. M., Andersson, P. L., Renman, G., Ahrens, L., Gros, M., Wiberg, K., Haglund, P. (2017). Non-target screening and prioritization of potentially persistent, bioaccumulating and toxic domestic wastewater contaminants and their removal in on-site and large-scale sewage treatment plants. Science of the Total Environment 575:265-275.		
HERO ID:		4143122		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling method was described in details, and lacked a few details about the storage condition and sampling equipment and specific procedure.
	Metric 2:	Analytical Methodology	Low	The analytical method was described, but LOD was not reported.
	Metric 3:	Biomarker Selection	N/A	The parent chemical was measured in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Sweden.
	Metric 5:	Currency	High	Non-target sampling took place in 2013, and target sampling took place in 2015.
	Metric 6:	Spatial and Temporal Variability	Medium	Sample size were not directly reported, but can be inferred than it had replicates.
	Metric 7:	Exposure Scenario	Medium	Exposure matrixes were not described in details.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No individual data points were reported either in main article or SI.
	Metric 9:	Quality Assurance	High	Quality assurance measures were explained in details.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study had limited discussion of limitations and variability.
Overall Quality Determination			Medium	

Study Citation:		Guerra, P., Kleywegt, S., Payne, M., Svoboda, M. L., Lee, H. B., Reiner, E., Kolic, T., Metcalfe, C., Smyth, S. A. (2015). Occurrence and Fate of Trace Contaminants during Aerobic and Anaerobic Sludge Digestion and Dewatering. Journal of Environmental Quality 44(4):1193-1200.		
HERO ID:		4161902		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is present
	Metric 2:	Analytical Methodology	High	detection limit table 1; description of method p.1194 and SI
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	5 Canadian WWTPs
	Metric 5:	Currency	Low	2008. Provided in Table S1 of supplemental file.
	Metric 6:	Spatial and Temporal Variability	Low	grab samples once per wk for 3 wks at each plant; n is 3 for dewatered biosolids; n is 9 for activated sludge;
	Metric 7:	Exposure Scenario	Medium	dewatered biosolids concentrations taken at WWTP
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	detection limits, n, median concentrations p. 1197 and fig 2; Figure S1 provides mean concentrations
	Metric 9:	Quality Assurance	Low	QA not discussed; might discuss measures taken in SI; compared results for consistency to previous reports
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	sampled at both cold and warm temps; since data not normally distributed, data evaluated by nonparametric methods
Overall Quality Determination			Medium	

Study Citation:		Tavera Busso, I., Tames, F., Silva, J. A., Ramos, S., Homem, V., Ratola, N., Carreras, H. (2017). Biomonitoring levels and trends of PAHs and synthetic musks associated with land use in urban environments. Science of the Total Environment 618:93-100.		
HERO ID:		4167987		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Samples were collected according to publicly available SOPs that are scientifically sound and widely accepted (i.e., from trusted or authoritative source) for the chemical and media of interest. provides only the range of LODs. The study is testing for the parent chemical in an environmental media.
	Metric 2:	Analytical Methodology	Low	
	Metric 3:	Biomarker Selection	N/A	
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Cordoba, Argentina publication in 2018. sampling date not reported. Timing of sample collection for monitoring data is not reported, discussed, or referenced. n=7, n=10, n=11; 3 scenarios Exposure scenarios presented were relevant to EPA’s risk assessment.
	Metric 5:	Currency	Low	
	Metric 6:	Spatial and Temporal Variability	Medium	
	Metric 7:	Exposure Scenario	High	
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	summary data; mean, SE, min, max refers to other publications
	Metric 9:	Quality Assurance	Medium	
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	SE included
Overall Quality Determination			Medium	

Study Citation:		Lefebvre, C., Kimpe, L. E., Metcalfe, C. D., Trudeau, V. L., Blais, J. M. (2017). Bioconcentration of polycyclic musks in fathead minnows caged in a wastewater effluent plume. Environmental Pollution 231(Pt 2):1593-1600.		
HERO ID:		4172003		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is present
	Metric 2:	Analytical Methodology	High	The analytical methodology is present
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	North Saskatchewan River locations upstream and downstream of WWTP serving city of Edmonton, AB, Canada
	Metric 5:	Currency	High	prior to 2015
	Metric 6:	Spatial and Temporal Variability	High	n is greater than 10; 6 sites along river (2 upstream and 4 downstream)
	Metric 7:	Exposure Scenario	Medium	caged fathead minnows in a river for one month upstream and downstream a WWTP; while the exposure scenarios assessed are relevant to HHCB's TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	limited data in text; all stats provided in Fig 2; raw data may be present in SI
	Metric 9:	Quality Assurance	High	mean recovery 74%; two method blanks for each fish extraction batch of six to ten samples
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	used one-way analysis of variance; statistical difference in Fig 2; discussed variations in concentrations consistent with previously reported concentrations
Overall Quality Determination			High	

Study Citation:		Elliott, S. M., Brigham, M. E., Lee, K. E., Banda, J. A., Choy, S. J., Gefell, D. J., Minarik, T. A., Moore, J. N., Jorgenson, Z. G. (2017). Contaminants of emerging concern in tributaries to the Laurentian Great Lakes: I. Patterns of occurrence. PLoS ONE 12(9):e0182868.		
HERO ID:		4181507		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Study Area and Sampling methods section plus SI analyzed at USGS NWQL Biomarkers did not appear to be relevant to this study.
	Metric 2:	Analytical Methodology	High	
	Metric 3:	Biomarker Selection	N/A	
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	discussed in Study Area during 2013 and 2014 292 surface water and 80 sediment samples; sites sampled twice (spring and summer)
	Metric 5:	Currency	Medium	
	Metric 6:	Spatial and Temporal Variability	High	
	Metric 7:	Exposure Scenario	High	The exposure scenarios assessed appear to be relevant to surface water exposure assessments of TSCA chemical risk evaluations.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	report limit, N, median, max, DF provided; additional info most likely in SI; all data available online (see reference 24, 25) summary of quality-control data available online; see reference 24 and 25
	Metric 9:	Quality Assurance	High	
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	There is some discussion of variability and uncertainty this discussion is lacking detail.
Overall Quality Determination			High	

Study Citation:		Zhang, X., Liang, G., Zeng, X., Zhou, J., Sheng, G., Fu, J. (2011). Levels of synthetic musk fragrances in human milk from three cities in the Yangtze River Delta in Eastern China. Journal of Environmental Sciences 23(6):983-990.		
HERO ID:		4181569		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	briefly discussed
	Metric 2:	Analytical Methodology	High	The analytical methodology is present
	Metric 3:	Biomarker Selection	High	fragrances in human milk
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	Medium	2006 and 2007
	Metric 6:	Spatial and Temporal Variability	Medium	no mention of replicates
	Metric 7:	Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data
	Metric 9:	Quality Assurance	Medium	no mention of biomarker stability
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	discussed different conc in different cities (spatial variability), considered effect of mother’s age on concentra-tions
Overall Quality Determination			Medium	

Study Citation:		Sengupta, A., Lyons, J. M., Smith, D. J., Drewes, J. E., Snyder, S. A., Heil, A., Maruya, K. A. (2014). The occurrence and fate of chemicals of emerging concern in coastal urban rivers receiving discharge of treated municipal wastewater effluent. Environmental Toxicology and Chemistry 33(2):350-358.		
HERO ID:		4181598		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The water sampling methodology was described in detail.
	Metric 2:	Analytical Methodology	Medium	The analytical methods were described, including LOD but did not report recoveries.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed water samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in 2 effluent-dominated rivers in southern California.
	Metric 5:	Currency	Medium	Samples were collected in 2011.
	Metric 6:	Spatial and Temporal Variability	High	Two sampling events at multiple locations on each river; 3 surface grabs collected at each station and subdivided into 3 bottles.
	Metric 7:	Exposure Scenario	High	The data closely represent relevant exposure scenarios related to surface water near water reclamation plants in Southern California.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	The authors only reported limited summary statistics. Data provided in SI tables.
	Metric 9:	Quality Assurance	Low	QA/QC techniques were briefly described, e.g., including the use of field blanks analyzed in parallel with water samples.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was not characterized for HHCB. Uncertainties were discussed.
Overall Quality Determination			Medium	

Study Citation:		Zeng, X., Mai, B., Sheng, G., Luo, X., Shao, W., An, T., Fu, J. (2008). Distribution of polycyclic musks in surface sediments from the Pearl River Delta and Macao Coastal Region, South china. Environmental Toxicology and Chemistry 27(1):18-23.		
HERO ID:		4181705		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Van Veen stainless-steel grab; top 5 cm f sediments; transported on ice; homogenized via sieve
	Metric 2:	Analytical Methodology	Medium	GC-MS; concentration normalized to dry sediment weight; DL ranged from 0.3-0.67ug/kg
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Pearl River in China
	Metric 5:	Currency	Low	October and November 2002
	Metric 6:	Spatial and Temporal Variability	Medium	six sediments (3 upper channel and 3 lower channel) Zhujiang River; 9 sediments from Dongjiang River; 5 sediments from Xijiang River; 3 samples from coast of Macao
	Metric 7:	Exposure Scenario	High	surface sediments from three major rivers in Pearl River China
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	detected in all samples; Table 2 provides individual concentrations
	Metric 9:	Quality Assurance	High	method blanks and spiked blanks in every batch of samples; recoveries in Table 1
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	compared to previous studies;
Overall Quality Determination			High	

Study Citation:		Yin, J., Wang, H., Li, J., Wu, Y., Shao, B. (2016). Occurrence of synthetic musks in human breast milk samples from 12 provinces in China. Food Additives & Contaminants: Part A, Chemistry, Analysis, Control, Exposure & Risk Assessment 33(7):1219-1227.		
HERO ID:		4181848		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Not all aspects of breast-milk donor selection were explained.
	Metric 2:	Analytical Methodology	High	Described originally in Wang et al. (2011).
	Metric 3:	Biomarker Selection	High	Parent chemical and metabolite (HHCB-lactone) in breast milk measured separately.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China, 12 provinces
	Metric 5:	Currency	Medium	2007
	Metric 6:	Spatial and Temporal Variability	High	Spatial variation: 24 pooled samples, from 12 urban and 12 rural, across 12 provinces (1,237 individual milk samples total, 1 urban and 2 rural sites per province).
	Metric 7:	Exposure Scenario	High	Breast milk is exposure pathway for infants.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Measured concentrations for 24 (pooled) milk samples listed by province and urban vs rural. Variation among individual women not assessed.
	Metric 9:	Quality Assurance	Medium	Appears high; descriptive statistics provided; description minimal.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Spatial variation and urban versus rural well characterized; individual variation not characterized. Compared with results of other studies. Uncertainties discussed.
Overall Quality Determination			High	

Study Citation:		Maruya, K. A., Dodder, N. G., Sengupta, A., Smith, D. J., Lyons, J. M., Heil, A. T., Drewes, J. E. (2016). Multimedia screening of contaminants of emerging concern (CECS) in coastal urban watersheds in southern California (USA). Environmental Toxicology and Chemistry 35(8):1986-1994.		
HERO ID:		4182703		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology for fish, river water and sediment sampling was described in detail: 1L of unfiltered water samples were collected using stainless steel bucket; sediment samples were collected using hand shovel and stored in a glass jar; fish samples were collected and wrapped in foil; storage temperature was defined; Table S1 and S2 provide sampling location and dates.
	Metric 2:	Analytical Methodology	High	Analytic methodology was described in detail: solid-phase extraction or accelerated solvent extraction was utilized; LC-MS/MS or GC-NCI/MS was utilized; recoveries were reported; reporting limits were provided in Tables S3 -S6.
	Metric 3:	Biomarker Selection	N/A	Sampling was conducted in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Sampling for river water and sediment was conducted in the Santa Clara River watershed in southern California. Fish samples were collected in the Los Angeles-Long Beach Harbor complex.
	Metric 5:	Currency	Medium	River water sampling was conducted during 2 low-flow events on 27 July and 15 October of 2013. Bed sediment was collected on 4 September 2013. Fish samples were collected in August of 2013 and May of 2014.
	Metric 6:	Spatial and Temporal Variability	High	10 water stations in the river watershed were sampled during 2 low-flow events. Bed sediments collected were collected in a single event (n=22). Fish tissues n=26 were collected in August of 2013 and May of 2014.
	Metric 7:	Exposure Scenario	High	The exposure scenario was described. Concentrations in coastal urban waterways, water, sediment, and fish tissue samples from effluent-dominated river and multiple embayments were reported.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data was provided in SI.
	Metric 9:	Quality Assurance	Low	Quality assurance details were provided and included recoveries and use of procedural and field blanks. Recovery of TCEP-d12 was variable and less than 10% for 7 of 23 sediment extracts, resulting in higher uncertainty and likely underestimated concentrations.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Some study uncertainties were presented. Results were compared to previous studies. Statistical summary measures of variability were not presented.
Overall Quality Determination			High	

Study Citation:		Cavalheiro, J., Zuloaga, O., Prieto, A., Preudhomme, H., Amouroux, D., Monperrus, M. (2017). Occurrence and Fate of Organic and Organometallic Pollutants in Municipal Wastewater Treatment Plants and Their Impact on Receiving Waters (Adour Estuary, France). Archives of Environmental Contamination and Toxicology 73(4):619-630.		
HERO ID:		4196927		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	3 WWTP and 8 estuary points (Fig 1)
	Metric 2:	Analytical Methodology	High	LVI-PTV-GC-MS; Results were an average of four replicates and were calculated by internal calibration; LOD and LOQ presented in Table 2
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Adour estuary in southwest France and 3 WWTP
	Metric 5:	Currency	Medium	October 2013, December 2013, and February 2014
	Metric 6:	Spatial and Temporal Variability	High	9 surface water sampling points and 3 WWTP; 3 months (October, December, and February); results average of 4 replicates
	Metric 7:	Exposure Scenario	High	study area includes cities; urban and industry
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 3 provides n, DF, range, and average; individual dataset available in SI
	Metric 9:	Quality Assurance	Medium	QA/QC section is brief; compared results to other studies
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	discusses variability p. 626-628 and Fig 2
Overall Quality Determination			High	

Study Citation:		Bizarro, C., Ros, O., Vallejo, A., Prieto, A., Etxebarria, N., Cajaraville, M. P., Ortiz-Zarragoitia, M. (2014). Intersex condition and molecular markers of endocrine disruption in relation with burdens of emerging pollutants in thicklip grey mullets (Chelon labrosus) from Basque estuaries (South-East Bay of Biscay). Marine Environmental Research 96:19-28.		
HERO ID:		4214525		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Section 2.1; surface water and fish samples (bile); surface water filtered
	Metric 2:	Analytical Methodology	High	LVI-PTV-GC-MS and GC-MS for surface water; GC-MS for fish bile; LOD and LOQ Tables 2 and 3
	Metric 3:	Biomarker Selection	N/A	Transcription levels of cyp19a1b in the brain and vtg in the liver; bile levels of HHCB and pesticides were positively correlated with transcription levels of vtg - our scope does not include biological responses
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	five estuaries of the Basque Coast in SE Bay of Biscay (Europe); Figure 1
	Metric 5:	Currency	Medium	June 2012
	Metric 6:	Spatial and Temporal Variability	High	at each sampling site (5 estuaries) 12-20 adult male mullets collected; three water subsamples per sampling site
	Metric 7:	Exposure Scenario	High	2 commercial port areas, one fishing port, one marina and downstream of sewage treatment plant
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Table 2 concentrations in surface water of each estuary; Table 3 mean and SD of bile analytes in male and intersex mullets; individual data not provided; no SI; no other statistics provided
	Metric 9:	Quality Assurance	Medium	recoveries were 66-129% and good repeatability (3-19%) for water samples; recoveries were 63-122% and good repeatability (1-24%) for fish bile
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	levels varied according to sampling sites
Overall Quality Determination			High	

Study Citation:		Homem, V., Magalhães, I., Alves, A., Santos, L. (2017). Assessing seasonal variation of synthetic musks in beach sands from Oporto coastal area: A case study. Environmental Pollution 226:190-197.		
HERO ID:		4263040		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling methodology is present, though could benefit from additional detail
	Metric 2:	Analytical Methodology	Medium	The analytical methodology is present, though could benefit from additional detail
	Metric 3:	Biomarker Selection	N/A	Chemical measured in environmental media
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Oporto’s coastal area
	Metric 5:	Currency	Medium	Samples were collected in the end of Summer (September 2013)and in the end of Winter (March 2014).
	Metric 6:	Spatial and Temporal Variability	Medium	5-10 samples for a single scenario
	Metric 7:	Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 3 (no raw data)
	Metric 9:	Quality Assurance	Medium	Lacks detail
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability and uncertainty discussion is insufficient
Overall Quality Determination			Medium	

Study Citation:		Hutter, H. P., Wallner, P., Hartl, W., Uhl, M., Lorbeer, G., Gminski, R., Mersch-Sundermann, V., Kundi, M. (2010). Higher blood concentrations of synthetic musks in women above fifty years than in younger women. International Journal of Hygiene and Environmental Health 213(2):124-130.		
HERO ID:		4264179		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Medium—Sampling methodology discussed in terms of sampling equipment, sample storage conditions. Insufficient information on sample storage duration.
	Metric 2:	Analytical Methodology	Low	Medium—Extraction methodology, analytical instrumentation, LOD’s and LOQ’s, recovery rates detailed. Insufficient information on matrix-adjustment and analytical instrument calibration.
	Metric 3:	Biomarker Selection	N/A	N/A—Sampling for parent chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	High—Vienna, Austria
	Metric 5:	Currency	Low	Low—Insufficient information on dates of serum sample collection.
	Metric 6:	Spatial and Temporal Variability	Medium	Low—Serum samples analyzed for n=53 women, however no replicate sampling, non-statistical sampling approach.
	Metric 7:	Exposure Scenario	Medium	Medium—Serum samples analyzed from women with insufficient information on relevancy of occupation, lack of field blanks/exposure controls.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Medium—Reported mean, range (within text) maximum concentrations with frequency of detection (Table 2), number of samples, multiple regression results adjusted for age, body surface, and frequency of consumer product use data detailed. Insufficient information on location of residence of volunteers providing samples (although sampling noted as taking place within Angiology Department in Vienna, Austria), dates of sampling, and raw data.
	Metric 9:	Quality Assurance	Medium	Medium—Documented quality assurance/quality control measures in terms of sample preparation, laboratory blanks for each sample batch. Insufficient information on correction for blank concentrations for Galaxolide, field blanks, and baseline/pre-exposure sampling.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Low—Sampling variability characterized, discussion of limitations lacking. Authors note intention of study was to compare samples in older women (this study, sampling collection date not specified) versus sample concentrations in younger women (Hutter et al., (2005) ID 5428345; Hutter et al., (2009) ID 5428336), but comparisons were not made using statistical analysis. Concentrations of Galaxolide and demographic/product use data were reported in older and younger women (Table 2 and Table 3, respectively), however no statistical comparisons were made for this data. Authors noted concentrations of polycyclic musks increased over the years, but did not account for year of sampling in comparisons between Galaxolide concentrations of older women (this study, sampling collection date not specified) and those of younger women from the original 2005 publication. Regression analysis predicting Galaxolide concentrations from consumer product predictors presented in Table 4 did not present covariate for older versus younger women, however text notes multivariate analysis indicated older persons showed higher concentrations.
Overall Quality Determination			Medium	

Study Citation:		Chase, D. A., Karnjanapiboonwong, A., Fang, Y., Cobb, G. P., Morse, A. N., Anderson, T. A. (2012). Occurrence of synthetic musk fragrances in effluent and non-effluent impacted environments. Science of the Total Environment 416:253-260.		
HERO ID:		4326553		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling methodology is present, though could benefit from additional detail
	Metric 2:	Analytical Methodology	Medium	The analytical methodology is present, though could benefit from additional detail
	Metric 3:	Biomarker Selection	N/A	Measured chemical in soil
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	City of Lubbock, Texas
	Metric 5:	Currency	Medium	Winter 2009 to Winter 2010.
	Metric 6:	Spatial and Temporal Variability	Low	<5 samples
	Metric 7:	Exposure Scenario	High	the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	No raw data
	Metric 9:	Quality Assurance	Medium	Lacks detail
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability and uncertainty discussion is insufficient
Overall Quality Determination			Medium	

Study Citation:		Matamoros, V., Arias, C. A., Nguyen, L. X., Salvadó, V., Brix, H. (2012). Occurrence and behavior of emerging contaminants in surface water and a restored wetland. Chemosphere 88(9):1083-1089.		
HERO ID:		4330586		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The water sampling methodology was well described.
	Metric 2:	Analytical Methodology	Medium	The analytical methods were described, including recoveries but did not include LOD values.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed water samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Denmark.
	Metric 5:	Currency	Medium	Samples were collected between September to December 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	n=29 water samples in total, with replicates.
	Metric 7:	Exposure Scenario	High	The data closely represent relevant exposure scenarios related to HHCB in freshwater in Denmark.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The authors reported summary statistics only (DF, min, max, and mean provided in Table 1).
	Metric 9:	Quality Assurance	Low	QA/QC techniques were briefly described.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability was characterized (range). Uncertainties and limitations were not discussed.
Overall Quality Determination			Medium	

Study Citation:		Barbosa, V., Maulvault, A. L., Alves, R. N., Kwadijk, C., Kotterman, M., Tediosi, A., Fernández-Tejedor, M., Sloth, J. J., Granby, K., Rasmussen, R. R., Robbins, J., De Witte, B., Trabalón, L., Fernandes, J. O., Cunha, S. C., Marques, A. (2018). Effects of steaming on contaminants of emerging concern levels in seafood. Food and Chemical Toxicology 118(Elsevier):490-504.		
HERO ID:		4618390		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling methodology is present, though could benefit from additional detail
	Metric 2:	Analytical Methodology	Medium	The analytical methodology is present, though could benefit from additional detail
	Metric 3:	Biomarker Selection	N/A	Chemical measured in food
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Europe
	Metric 5:	Currency	High	2015 to present
	Metric 6:	Spatial and Temporal Variability	Low	<5 samples per fish
	Metric 7:	Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Lacks detail
	Metric 9:	Quality Assurance	Low	Lacks detail
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability and uncertainty discussion is insufficient
Overall Quality Determination			Medium	

Study Citation:		Baurès, E., Blanchard, O., Mercier, F., Surget, E., le Cann, P., Rivier, A., Gangneux, J. P., Florentin, A. (2018). Indoor air quality in two French hospitals: Measurement of chemical and microbiological contaminants. Science of the Total Environment 642:168-179.		
HERO ID:		4729972		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The air sampling methodology was described in detail.
	Metric 2:	Analytical Methodology	Medium	The analytical methods were described and included LOD/LOQ but not recoveries.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed air samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in France.
	Metric 5:	Currency	Medium	The samples were collected between June 2014 and February 2015
	Metric 6:	Spatial and Temporal Variability	High	n>10 air samples, with replicates.
	Metric 7:	Exposure Scenario	High	The data closely represent relevant exposure scenarios related indoor airborne pollutants in French Hospitals.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The authors reported summary statistics and raw data.
	Metric 9:	Quality Assurance	High	The authors described QA/QC techniques in detail.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability was characterized (SD, range). Little information was reported on limitations and gaps.
Overall Quality Determination			High	

Study Citation:		Blum, K. M., Andersson, P. L., Ahrens, L., Wiberg, K., Haglund, P. (2018). Persistence, mobility and bioavailability of emerging organic contaminants discharged from sewage treatment plants. Science of the Total Environment 612:1532-1542.		
HERO ID:		4829919		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology described and preparation of samples detailed in SI.
	Metric 2:	Analytical Methodology	High	Analytical methodology presented in detail. Both LOD and LOQ presented in Tables S8 and S9.
	Metric 3:	Biomarker Selection	N/A	Parent chemical measured in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected from River Fyris, affected by STP in Uppsala municipality, Sweden.
	Metric 5:	Currency	High	Surface water collected in December 2014, March 2015, June 2015 and September 2015; effluent in November 2015; fish June 2014; sediment September 2015.
	Metric 6:	Spatial and Temporal Variability	Medium	Fish (n=10) caught close to Site A nd B, surface waters from 4 different sites (A, B, C, and S), and catchment area sampled over all four seasons. Replicate samples reported. Sediment sampled once.
	Metric 7:	Exposure Scenario	High	Study sampled a river affected by small to large-scale sewage treatment plants.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Discussion of results in Section 3 with data presented in Figures 2 and 7 and Table 4. SI provided individual data.
	Metric 9:	Quality Assurance	Medium	QA/QC discussion in Section 2.8. Detailed recovery information provided in SI.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability and uncertainty not reported in main text. Limited to samples taken during 1 month in each of the four seasons. Integrative and grab samples results agreed well.
Overall Quality Determination			High	

Study Citation:		Moldovan, Z., Marincas, O., Povar, I., Lupascu, T., Longree, P., Rota, J. S., Singer, H., Alder, A. C. (2018). Environmental exposure of anthropogenic micropollutants in the Prut River at the Romanian-Moldavian border: A snapshot in the lower Danube river basin. Environmental Science and Pollution Research 25(31):31040–31050.		
HERO ID:		4854965		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	grab samples; discusses sampling procedures and storage, as well as study site characteristics; samples filtered
	Metric 2:	Analytical Methodology	Medium	GC-MS and LC-HRMS; LOQ greater than or equal to 10 ng/L for GC and 0.1 - 100 ng/L for LC-HRMS
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Prut River in Ukraine, Romania, and Moldova
	Metric 5:	Currency	Medium	May and November 2011 and June 2012
	Metric 6:	Spatial and Temporal Variability	Medium	three sampling campaigns at six locations
	Metric 7:	Exposure Scenario	High	Catchment of Prut is affected by agriculture, urban wastewater discharge, waste disposal and outdated industrial production modes
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	concentration ranges, average, percentiles depicted in figure 2 and p. 31045; individual data presented in SI
	Metric 9:	Quality Assurance	High	recoveries 62-106%; standards showed linear range; results corrected with corresponding relative recoveries; used blanks
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	analyses performed in duplicate
Overall Quality Determination			High	

Study Citation:		Buszka, P. M., Yeskis, D. J., Kolpin, D. W., Furlong, E. T., Zaugg, S. D., Meyer, M. T. (2009). Waste-indicator and pharmaceutical compounds in landfill-leachate-affected ground water near Elkhart, Indiana, 2000-2002. Bulletin of Environmental Contamination and Toxicology 82(6):653-659.		
HERO ID:		4912133		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methodology parameters were missing such as sampler calibration and storage conditions. Samples were "chilled" but did not provide temperature.
	Metric 2:	Analytical Methodology	Medium	Some analytical methodology parameters were missing, such as calibration. Detailed methods were provided in references listed by the study. LOD reported (Table 3).
	Metric 3:	Biomarker Selection	N/A	Parent chemical was measured in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The samples were collected in Elkhart, Indiana.
	Metric 5:	Currency	Low	The samples were collected in 2000-2002.
	Metric 6:	Spatial and Temporal Variability	Low	Only 4 wells were sampled. No duplicates were collected.
	Metric 7:	Exposure Scenario	High	The exposure scenario represented closely the environment of wells downgradient from a landfill.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Only individual data but no summary statistics were reported. Data reported in table 2.
	Metric 9:	Quality Assurance	Low	The study reported low recoveries (<70%). Field blanks were reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Comparison of results were made to other studies. No sample variability and key limitations were reported.
Overall Quality Determination			Medium	

Study Citation:		Alvarez, D., Cranor, W., Perkins, S., Schroeder, V., Werner, W. (2008). Reconnaissance of Persistent and Emerging Contaminants in the Shenandoah and James River Basins, Virginia, During Spring of 2007. GRA and I(e 1):20.		
HERO ID:		5017218		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling is discussed in pages 2-6.
	Metric 2:	Analytical Methodology	Medium	the MDLs and MQLs were expressed as the mass of chemical sequestered by a single sampler (ng/POCIS or ng/SPMD)
	Metric 3:	Biomarker Selection	N/A	Biomarkers were not applicable to this studye and threfore not assessed.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Locations are: Shenandoah and James River Basins, Virginia.
	Metric 5:	Currency	Medium	Sampling time is 2007.
	Metric 6:	Spatial and Temporal Variability	High	three SPMDs and six POCIS in water for periods of 42 to 49 days
	Metric 7:	Exposure Scenario	High	The assessed exposure scenarios appear relevant to potential TSCA surface water chemical exposure assess- ments.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	detection reported as mass of chemical sequestered by a single sampler (ng/POCIS or ng/SPMD) which is more qualitative
	Metric 9:	Quality Assurance	Medium	controls used; recoveries reported; no matrix blanks for passive samplers supplied by vendor
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	no std provided; uncertainties identified and discused
Overall Quality Determination			Medium	

Study Citation:		Biel-Maeso, M., Corada-Fernández, C., Lara-Martín, P. A. (2018). Removal of personal care products (PCPs) in wastewater and sludge treatment and their occurrence in receiving soils. Water Research 150:129-139.		
HERO ID:		5017319		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling methodology is present, though could benefit from additional detail
	Metric 2:	Analytical Methodology	Low	The analytical methodology lacks detail
	Metric 3:	Biomarker Selection	N/A	Chemical is measured in soil
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Jerez de la Frontera (SW) Spain.
	Metric 5:	Currency	High	2014 to June 2015.
	Metric 6:	Spatial and Temporal Variability	Medium	number of samples unclear
	Metric 7:	Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Further information on the analytical standardsand methods used can be found both in the aforementionedreferences as well as in the section “Analytical methodology” inSupporting Information. More detailed information on the concentrations of individual contaminants can be found in Tables S11, S12 and S13.
	Metric 9:	Quality Assurance	Low	Poor description of QA/QC
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty discussion is insufficient
Overall Quality Determination			Medium	

Study Citation:		Winkler, M., Kopf, G., Hauptvogel, C., Neu, T. (1998). Fate of artificial musk fragrances associated with suspended particulate matter (SPM) from the River Elbe (Germany) in comparison to other organic contaminants. Chemosphere 37(6):1139-1156.		
HERO ID:		5149743		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	SPM samples collected with a continuous flow through centrifuge; mixed water sample collected every half hour by taking a tenth period of the endvolume of the sample; filtered
	Metric 2:	Analytical Methodology	High	GC-ECD, GC-MS, and HPLC; Tables 2 and 3 reports DL (4 ng/g in SPM and 2 ng/g in surface water)
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	River Elbe in Magdeburg, Germany
	Metric 5:	Currency	Low	June 1996 to May 1997
	Metric 6:	Spatial and Temporal Variability	High	June - May; weekly for first 4 months and then biweekly
	Metric 7:	Exposure Scenario	Medium	does not directly describe the setting of the Elbe River
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	range, mean, median, and 90% percentile presented in Tables 2 and 3; raw data not provided
	Metric 9:	Quality Assurance	High	recovery >70%; control samples
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	std tested; discusses variation; no significant seasonal differences
Overall Quality Determination			High	

Study Citation: Oros, D. R., Jarman, W. M., Lowe, T., David, N., Lowe, S., Davis, J. A. (2003). Surveillance for previously unmonitored organic contaminants in the San Francisco estuary. Marine Pollution Bulletin 46(9):1102-1110.

HERO ID: 5162636

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	High	Sampling is discussed in section 2.1.
Metric 2:	Analytical Methodology	Medium	method detection limit about 250 pg/l; concentrations blank corrected
Metric 3:	Biomarker Selection	N/A	Biomarkers were not assessed nor relevant to this study.
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	San Francisco Estuary; different Bay regions
Metric 5:	Currency	Low	1999 and 2000
Metric 6:	Spatial and Temporal Variability	Critically Deficient	sample size not reported; samples collected were 100 l of water pumped at a flow rate of 1.5 l/min
Metric 7:	Exposure Scenario	High	surface water
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Low	individual data points not reported; concentration by the different Bay regions provided; maximum concentration identified; not detected reported
Metric 9:	Quality Assurance	Low	no QA section; samples were determined by comparing their response factors to those of the quantitation internal standard
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	variability not discussed

Overall Quality Determination

Uninformative

Study Citation:		Zeng, X., Xu, L., Liu, J., Wu, Y., Yu, Z. (2017). Occurrence and distribution of organophosphorus flame retardants/plasticizers and synthetic musks in sediments from source water in the Pearl River Delta, China. Environmental Toxicology and Chemistry 37(4):975-982.		
HERO ID:		5163442		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology briefly discussed, including sampling equipment, procedures, storage conditions, and site characteristics.
	Metric 2:	Analytical Methodology	High	Analytical methodology provided. LODs and LOQs listed in Table S2.
	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	Sampling from the Pearl River in Southern China.
	Metric 5:	Currency	Low	No sampling date provided, but article published 2018 (received 2017).
	Metric 6:	Spatial and Temporal Variability	Medium	15 study locations (water sources for 9 cities) with a total of 15 sediment samples. No replicate samples.
	Metric 7:	Exposure Scenario	High	Samples from a river that is a drinking water source for surrounding inhabitants, in developed, high-risk region.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Individual data points provided in Table 2. Summary statistics provided in text, including mean and range.
	Metric 9:	Quality Assurance	Medium	QA/QC provided, including blanks and spiked samples. Recovery not provided for this chemical.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some discussion of variation provided.
Overall Quality Determination			High	

Study Citation:		Page, D., Miotliński, K., Gonzalez, D., Barry, K., Dillon, P., Gallen, C. (2014). Environmental monitoring of selected pesticides and organic chemicals in urban stormwater recycling systems using passive sampling techniques. Journal of Contaminant Hydrology 158(Elsevier):65-77.		
HERO ID:		5298744		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The water sampling methodology was concisely described.
	Metric 2:	Analytical Methodology	Medium	The analytical methods were described, but recoveries and LOD were not reported.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed water samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The samples were collected in South Australia.
	Metric 5:	Currency	Medium	The samples were collected in 2011 and 2012
	Metric 6:	Spatial and Temporal Variability	Medium	n=5 sampling locations with <5 replicates per site.
	Metric 7:	Exposure Scenario	High	The data likely represent relevant exposure scenarios related to stormwater in South Australia, but details about the population of interest were missing.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Limited summary statistics were reported. Individual sample concentrations were not reported.
	Metric 9:	Quality Assurance	Low	Limited details about QA/QC techniques were reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was not characterized. Uncertainties and study limitations were briefly discussed.
Overall Quality Determination			Medium	

Study Citation:		Gadelha, J. R., Rocha, A. C., Camacho, C., Eljarrat, E., Peris, A., Aminot, Y., Readman, J. W., Boti, V., Nannou, C., Kapsi, M., Albanis, T., Rocha, F., Machado, A., Bordalo, A., Valente, L. M. P., Nunes, M. L., Marques, A., Almeida, C. M. R. (2019). Persistent and emerging pollutants assessment on aquaculture oysters (<i>Crassostrea gigas</i>) from NW Portuguese coast (Ria De Aveiro). Science of the Total Environment 666:731-742.		
HERO ID:		5305891		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling area and procedures were adequately described. Water and sediments were sampled over four seasons and oyster characteristics were measured.
	Metric 2:	Analytical Methodology	High	Details on extraction method, LOD, LOQ, % recovery, reproducibility described in Supplementary Materials.
	Metric 3:	Biomarker Selection	N/A	Parent chemical concentration measured in oyster soft tissues.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Portugal.
	Metric 5:	Currency	High	Samples were collected from 2016 to 2017.
	Metric 6:	Spatial and Temporal Variability	Low	Sampling occurred in 4 seasons. 20 oysters each for chemical analysis were homogenized together and divided into five lots; one lot was analyzed per chemical group. N = 3 triplicate measures per chemical per season.
	Metric 7:	Exposure Scenario	High	The exposure scenario was oysters from aquaculture, which are consumed by people. Water and sediments from the same location were also evaluated.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Mean and SD was reported for homogenized oysters from each of 4 seasons for each chemical. N = 3, for water, sediment, and oysters.
	Metric 9:	Quality Assurance	Medium	QA was discussed generally; details might be provided in Supplementary Materials.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Seasonal variations were discussed and oyster, water, and sediment concentrations were compared. Variation among individual oysters or between different aquaculture locations was not addressed.
Overall Quality Determination			Medium	

Study Citation:		Hu, Z., Shi, Y., Cai, Y. (2011). Concentrations, distribution, and bioaccumulation of synthetic musks in the Haihe River of China. Chemosphere 84(11):1630-1635.		
HERO ID:		5349141		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	sampling equipment and procedure not discussed; discusses number of samples and locations as well as time
	Metric 2:	Analytical Methodology	High	brief discussion of extraction, detailed info in SI; GC-MS; LOD range provided but assume more info 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	Haihe River, largest water system in North China; also Dagou Drainage River and Chentaizi Drainage River
	Metric 5:	Currency	Medium	December 29-30, 2008
	Metric 6:	Spatial and Temporal Variability	High	23 surface water samples and 13 sediment samples along 23 sites of the rivers; seven fish samples from river and 10 fish samples from 4 ponds
	Metric 7:	Exposure Scenario	High	500 million tons sewage discharged into Haihe River area
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	concentrations listed in SI - Table S1 for surface water, Table S2 for sediment; Table S3 for fish
	Metric 9:	Quality Assurance	High	blanks, recoveries, and deviations within acceptable ranges; concentrations corrected with recovery of surrogate standards
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	discussed discrepancy; compared to other studies
Overall Quality Determination			High	

Study Citation:		Albrecht, C., Lorenz, W. (2014). Occurrence of synthetic musk compounds and their fate in the aquatic environment of the river Saale in Germany. Fresenius Environmental Bulletin 23(7):1455-1463.		
HERO ID:		5427809		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	water samples filtered; air dried sediment samples sieved and fraction up to 100um particle size used for extraction; effluent also collected
	Metric 2:	Analytical Methodology	High	surface water extracted in triplicate by SPE; sediment extracted with n-pentane using ultrasonic bath; GC-MS; LOD and LOQ in Table 2
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	river Saale in city of Halle, Germany; local STP “Kläranlage Halle-Nord”
	Metric 5:	Currency	Medium	June 2011 to May 2012
	Metric 6:	Spatial and Temporal Variability	High	13 locations sampled over 12 month period; N for surface water = 144;
	Metric 7:	Exposure Scenario	High	local STP discharges into river; also urban and rural areas along river
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No individual samples or SI; provides DF, range, median, mean, SD; arithmetic mean from 3 individual extractions; checked for normal distribution and outliers
	Metric 9:	Quality Assurance	High	discusses QA; recoveries 81-117% for water and 62-96% for sediment; concentration in final samples were not corrected for the determined recoveries
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	discussed risk of cross contamination and high blank values; compared to other studies; SD reported
Overall Quality Determination			High	

Study Citation:		Bargar, T. A., Garrison, V. H., Alvarez, D. A., Echols, K. R. (2013). Contaminants assessment in the coral reefs of Virgin Islands National Park and Virgin Islands Coral Reef National Monument. Marine Pollution Bulletin 70(1-2):281-288.		
HERO ID:		5427811		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Samples were collected according to publicly available SOPs that are scientifically sound and widely accepted (i.e., from trusted or authoritative source) for the chemical and media of interest. performed at USGS Research Center; Table 2 presents MDLs: polar organic chemical integrative sampler (POCIS) and semi-permeable membrane device (SPMD) the study is testing for the parent chemical in an environmental media.
	Metric 2:	Analytical Methodology	Medium	
	Metric 3:	Biomarker Selection	N/A	
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	coral reefs locations in Virgin Islands
	Metric 5:	Currency	Low	no sampling date provided but published in 2013
	Metric 6:	Spatial and Temporal Variability	Medium	3 POCIS and 2 SPMD deployed at each site and retrieved about 28 days later; 2 of 3 POCIS from each location combined into single sample to enhance sensitivity to chemicals
	Metric 7:	Exposure Scenario	High	The data closely represent relevant exposure scenario
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	individual data, data set info not provided; no SI; MDL provided; estimated concentrations either below MDL or less then MQL
	Metric 9:	Quality Assurance	Medium	rigorous QC plan employed, including blanks, recovery and controls; specifics not provided (p. 283)
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	compare results to other studies
Overall Quality Determination			Medium	

Study Citation:		Arrubla, J. P., Cubillos, J. A., Ramirez, C. A., Arredondo, J. A., Arias, C. A., Paredes, D. (2016). Pharmaceutical and personal care products in domestic wastewater and their removal in anaerobic treatment systems: septic tank - up flow anaerobic filter. 36(1):70-78.		
HERO ID:		5427823		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	4L sample at inflow and outflow at four sampling events; 6 hr during dry season; stored in glass containers; all samples filtered
	Metric 2:	Analytical Methodology	Low	SPE; GC-MS; detection limits not provided; no 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	rural area of Pereira, Colombia; La Florida located in middle basin of Otun River
	Metric 5:	Currency	Low	sampling dates not provided; 2016 publication
	Metric 6:	Spatial and Temporal Variability	Low	four sampling events; each sampling was made during a composition period of 6 hrs
	Metric 7:	Exposure Scenario	High	wastewater to and from a treatment plant in rural area of Columbia; effluent discharged into Otun River which is upstream of the water intake of the supply system of the city Pereira
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	max, min, and average reported in Table 2; no other statistics provided; no SI
	Metric 9:	Quality Assurance	Low	QA/QC not directly discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Briefly discussed in page 75 and 76.
Overall Quality Determination			Low	

Study Citation: Winkler, M., Headley, J. V., Peru, K. M. (2000). Optimization of solid-phase microextraction for the gas chromatographic-mass spectrometric determination of synthetic musk fragrances in water samples. Journal of Chromatography A 903(1-2):203-210.

HERO ID: 5427882

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Sampling Methodology	Critically Deficient	sampling methodology not discussed
	Metric 2: Analytical Methodology	Low	SPME; LODs 14-22 ng/L
	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	Elbe River, near Magdeburg
	Metric 5: Currency	Low	sampling date not provided; published 2000
	Metric 6: Spatial and Temporal Variability	Low	6 water samples
	Metric 7: Exposure Scenario	Medium	river setting not described; beside in vicinity of Magdeburg
Domain 3: Accessibility/Clarity	Metric 8: Reporting of Results	Low	ambient levels in river was 117 ng/L
	Metric 9: Quality Assurance	Low	Lacks discussion of QA protocol.
Domain 4: Variability and Uncertainty	Metric 10: Variability and Uncertainty	Low	Lacks discussion of variability and uncertainty.

Overall Quality Determination

Uninformative

Study Citation:		Yang, J. J., Metcalfe, C. D. (2006). Fate of synthetic musks in a domestic wastewater treatment plant and in an agricultural field amended with biosolids. Science of the Total Environment 363(1-3):149-165.		
HERO ID:		5427892		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling methodology is present, though could benefit from additional detail
	Metric 2:	Analytical Methodology	Medium	The analytical methodology is present, though could benefit from additional detail
	Metric 3:	Biomarker Selection	N/A	Measured chemical in soil
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Peterborough WWTP
	Metric 5:	Currency	Medium	Samples of soil were collected pre-application (October 8, 2003), and postapplication at 1 day (October 11, 2003) 2, 4 and 6weeks (October 24, November 7, November 20,2003) and 6 months (April 8, 2004).
	Metric 6:	Spatial and Temporal Variability	High	42 samples
	Metric 7:	Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Table 2 and 3
	Metric 9:	Quality Assurance	Medium	QA/QC could be more detailed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability and uncertainty discussion is insufficient
Overall Quality Determination			Medium	

Study Citation:		Zhang, X., Yao, Y.,u, Zeng, X., Qian, G., Guo, Y., Wu, M., Sheng, G., Fu, J. (2008). Synthetic musks in the aquatic environment and personal care products in Shanghai, China. Chemosphere 72(10):1553-1558.		
HERO ID:		5427894		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling methodology is present, though could benefit from additional detail
	Metric 2:	Analytical Methodology	Medium	The analytical methodology is present, though could benefit from additional detail
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Suzhou Creek
	Metric 5:	Currency	Medium	March 20 and 26, 2007.
	Metric 6:	Spatial and Temporal Variability	Medium	n=8
	Metric 7:	Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Table 3
	Metric 9:	Quality Assurance	High	No QA/QC issues have been identified which significantly interfere with the overall reliability of the study
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability and uncertainty discussion is insufficient
Overall Quality Determination			Medium	

Study Citation:		Yao, L., Lv, Y. Z., Zhang, L. J., Liu, W. R., Zhao, J. L., Yang, Y. Y., Jia, Y. W., Liu, Y. S., He, L. Y., Ying, G. G. (2019). Bioaccumulation and risks of 24 personal care products in plasma of wild fish from the Yangtze River, China. Science of the Total Environment 665:810-819.		
HERO ID:		5427897		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is present
	Metric 2:	Analytical Methodology	High	The analytical methodology is present
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Yangtze River, China
	Metric 5:	Currency	Medium	2013
	Metric 6:	Spatial and Temporal Variability	High	n=34
	Metric 7:	Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	raw data not shown
	Metric 9:	Quality Assurance	High	No QA/QC issues have been identified which significantly interfere with the overall reliability of the study
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability and uncertainty discussion is insufficient
Overall Quality Determination			High	

Study Citation:		Zeng, X., Sheng, G., Xiong, Y., Fu, J. (2005). Determination of polycyclic musks in sewage sludge from Guangdong, China using GC-EI-MS. Chemosphere 60(6):817-823.		
HERO ID:		5427898		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	sampling methodology only briefly discussed
	Metric 2:	Analytical Methodology	High	Samples were analyzed according to analytical methods that are scientifically sound and widely accepted (i.e., from trusted or authoritative source) and are appropriate for the chemical and media of interest.
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	m Guangdong, China
	Metric 5:	Currency	Low	No sampling date provided. Published in 2005.
	Metric 6:	Spatial and Temporal Variability	Medium	duplicate samples collected in only some plants
	Metric 7:	Exposure Scenario	Medium	The data represent relevant exposure scenarios.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	no measure of variation
	Metric 9:	Quality Assurance	High	No quality assurance issues identified.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	no standard deviation or other variance provided
Overall Quality Determination			Medium	

Study Citation:		Yao, L., Zhao, J. L., Liu, Y. S., Zhang, Q. Q., Jiang, Y. X., Liu, S., Liu, W. R., Yang, Y. Y., Ying, G. G. (2018). Personal care products in wild fish in two main Chinese rivers: Bioaccumulation potential and human health risks. Science of the Total Environment 621:1093-1102.		
HERO ID:		5427899		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling equipment, transportation and storage were described.
	Metric 2:	Analytical Methodology	Low	SI is needed for full evaluation. DL not reported in main paper. Brief method summary was included in the methods, including extraction kits and equipment.
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China, Pearl River and Yangtze River
	Metric 5:	Currency	Medium	2012-2013
	Metric 6:	Spatial and Temporal Variability	Medium	More details are available in the SI. Muscle tissue was collected from 81 fish and liver tissue from 74 fish.
	Metric 7:	Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 2 includes detection frequency, range, mean, and median.
	Metric 9:	Quality Assurance	Medium	Blanks were discussed. Recoveries are included in the SI.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not discussed.
Overall Quality Determination			Medium	

Study Citation:		Yin, J., Wang, H., Zhang, J., Zhou, N., Gao, F., Wu, Y., Xiang, J., Shao, B. (2012). The occurrence of synthetic musks in human breast milk in Sichuan, China. Chemosphere 87(9):1018-1023.		
HERO ID:		5427900		
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 (Human milk)
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Southwestern China
	Metric 5:	Currency	Medium	Samples collected in 2009
	Metric 6:	Spatial and Temporal Variability	Medium	>10 samples; no replicates
	Metric 7:	Exposure Scenario	High	The data represent the relevant exposure scenario. The study describes the setting (location). More info may be in the questioner mentioned in the study.
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:		Zhang, H., Kelly, B. C. (2018). 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	Detection frequency, geometric mean, sample size, and 95% confidence interval reported by fish species and by medium in Supplemental Tables.
	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:	Zeng, X. Y., Cao, S. X., Zhang, D. L., Gao, S. T., Yu, Z. Q., Li, H. R., Sheng, G. Y., Fu, J. M. (2012). Levels and distribution of synthetic musks and polycyclic aromatic hydrocarbons in sludge collected from Guangdong Province. Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 47(3):389-397.			
HERO ID:	5427904			
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Sampling Methodology	Medium	not a lot of detail on sampling methodology/equipment	
	Metric 2: Analytical Methodology	Low	GC-MS; no detection limits provided; no SI	
	Metric 3: Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.	
Domain 2: Representativeness	Metric 4: Geographic Area	High	six cities in Guangdong Province, China	
	Metric 5: Currency	Medium	Table 1.	
	Metric 6: Spatial and Temporal Variability	Medium	19 WWTPs; does not say how many times sampled per plant	
	Metric 7: Exposure Scenario	High	19 WWTPs - 9 domestic sewage, 2 industrial, and 8 treated mixtures of domestic and industrial wastewater; see Table 1	
Domain 3: Accessibility/Clarity	Metric 8: Reporting of Results	Medium	Table 2 provides concentration in sludge per plant (ug/kg dw)	
	Metric 9: Quality Assurance	High	QA/QC discussed on page p. 391; blanks and duplicate samples; recoveries ranged from 50.90-97.19	
Domain 4: Variability and Uncertainty	Metric 10: Variability and Uncertainty	Medium	Fig 1 variance	
Overall Quality Determination		Medium		

Study Citation:		Tamura, I., Kimura, K., Kameda, Y., Nakada, N., Yamamoto, H. (2013). Ecological risk assessment of urban creek sediments contaminated by untreated domestic wastewater: potential contribution of antimicrobials and a musk fragrance. Environmental Technology 34(12):1567-1575.		
HERO ID:		5427931		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	grab samples using a scoop from surface; sediment from center of stream during day when flooding had not occurred; stored at 4C; samples centrifuged to remove supernatant liquid and then screened through 2 mm mesh
	Metric 2:	Analytical Methodology	Low	extracted using acetone twice; GC-MS; LOD between 0.1 and 0.5 ug/L
	Metric 3:	Biomarker Selection	N/A	Biomarkers were not reported
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Tamiya Creek located in the western area of Tokushima City, and Tsumeta Creek in the southern part of this city - Japan (Fig 1)
	Metric 5:	Currency	Medium	December 2011 and July 2012
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	two rivers sampled; information pertaining to samples not provided
	Metric 7:	Exposure Scenario	High	two river sediments in urban streams in an unsewered residential catchment area
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Fig 3 provides concentrations of HHCB per river; concentrations in order of 100 ng/g; no summary statistics provided; no SI
	Metric 9:	Quality Assurance	Low	QA/QC not discussed; compared values to other studies which aligned
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	minimal discussion; untreated domestic wastewater in the sampling sites may be cause of the relatively higher concentration; volatility may be part of reason for lower concentrations in summer
Overall Quality Determination			Uninformative	

Study Citation:		Zouhar, L., Vavrova, M., Mravcova, L., Kubickova, K., Vecerek, V. (2012). Evaluation of wastewater contamination by musk compounds. Fresenius Environmental Bulletin 21(11A):3352-3356.		
HERO ID:		5427939		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling methodology is present, though could benefit from additional detail
	Metric 2:	Analytical Methodology	High	SPME; GC/MS; LOD and LOQ reported in Table 1
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	WWTP in Brno-Modrice
	Metric 5:	Currency	Medium	February 2010
	Metric 6:	Spatial and Temporal Variability	High	collected every day for 28 days; each sample aliquot volumes of wastewater for 24 hr; eliquot taken every 2hr
	Metric 7:	Exposure Scenario	Medium	no discussion of the WWTP; effluent discharges into river Svratka
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1 lists average content and repeatability; Table 2 lists range and median; individual data not provided
	Metric 9:	Quality Assurance	Low	Poor description of QA/QC
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	repeatability % Table 1
Overall Quality Determination			Medium	

Study Citation:		Trabalón, L., Cano-Sancho, G., Pocurull, E., Nadal, M., Domingo, J. L., Borrull, F. (2015). Exposure of the population of Catalonia (Spain) to musk fragrances through seafood consumption: Risk assessment. Environmental Research 143(Pt B):116-122.		
HERO ID:		5427987		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	composite sample from 3 different locations
	Metric 2:	Analytical Methodology	High	MDL in Table 3
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Catalonia and Tarragona, Spain
	Metric 5:	Currency	Medium	This survey was carried out between 2009 and 2010 with 3000individuals (50% males and females).
	Metric 6:	Spatial and Temporal Variability	High	10 types of aquatic species
	Metric 7:	Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	raw data Table 4 - composite samples
	Metric 9:	Quality Assurance	Medium	Lacks sufficient detail
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability and uncertainty were not clearly discussed
Overall Quality Determination			High	

Study Citation:		Tseng, W. J., Tsai, S. W. (2019). Assessment of dermal exposures for synthetic musks from personal care products in Taiwan. Science of the Total Environment 669:160-167.		
HERO ID:		5427988		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling Methodology	High	The sampling methodology is present
	Metric 2:	Analytical Methodology	High	The analytical methodology is present
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness	Metric 4:	Geographic Area	High	Taiwan
	Metric 5:	Currency	Critically Deficient	Timing of sample collection not reported.
	Metric 6:	Spatial and Temporal Variability	Medium	>10 samples but no replicates
	Metric 7:	Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB's TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity	Metric 8:	Reporting of Results	Medium	no raw data
	Metric 9:	Quality Assurance	High	No QA/QC issues have been identified which significantly interfere with the overall reliability of the study
Domain 4: Variability and Uncertainty	Metric 10:	Variability and Uncertainty	Medium	no limitations reported
Overall Quality Determination		Uninformative		

Study Citation:		Wanda, E. M. M., Nyoni, H., Mamba, B. B., Msagati, T. A. M. (2017). Occurrence of Emerging Micropollutants in Water Systems in Gauteng, Mpumalanga, and North West Provinces, South Africa. International Journal of Environmental Research and Public Health 14(1):79.		
HERO ID:		5428001		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	grab samples in triplicate; filtered
	Metric 2:	Analytical Methodology	High	SPE; GCxGC-HRTOFMS; LOQ and LOD Table 3
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Mpumalanga, Gauteng, and NW Provinces of South Africa
	Metric 5:	Currency	High	June 2014 to April 2016
	Metric 6:	Spatial and Temporal Variability	High	44 water sources; collected every 2 months ; grab water samples in triplicate
	Metric 7:	Exposure Scenario	High	locations within drinking water and wastewater sources
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Table 5 provides raw data; measured in triplicate; mean concentration per site (type of water source identified) and SD
	Metric 9:	Quality Assurance	High	table 2 recoveries
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	no evidence of statistically significant temporal variations; good linearity and reproducibility of analyses achieved; compared to other studies
Overall Quality Determination			High	

Study Citation:		Wang, Q., Kelly, B. C. (2018). Assessing bioaccumulation behaviour of hydrophobic organic contaminants in a tropical urban catchment. Journal of Hazardous Materials 358:366-375.		
HERO ID:		5428002		
Domain		Metric	Rating	Comments
Domain 1: Reliability		Metric 1: Sampling Methodology	Medium	no map and sample time on ice not included
		Metric 2: Analytical Methodology	Low	no LOD
		Metric 3: Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness		Metric 4: Geographic Area	High	Singapore
		Metric 5: Currency	High	2014 to 2016
		Metric 6: Spatial and Temporal Variability	High	n=7, n=8, n=9, n=26, n=16, n=183; 4 aquatic biota, sediment, and water
		Metric 7: Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity		Metric 8: Reporting of Results	Medium	summary data; mean and range
		Metric 9: Quality Assurance	Medium	Quality is discussed, but refers to other publication.
Domain 4: Variability and Uncertainty		Metric 10: Variability and Uncertainty	Medium	Variability and uncertainty were not clearly discussed
Overall Quality Determination			Medium	

Study Citation:		Ramirez, A. J., Brain, R. A., Usenko, S., Mottaleb, M. A., O’Donnell, J. G., Stahl, L. L., Wathen, J. B., Snyder, B. D., Pitt, J. L., Perez-Hurtado, P., Dobbins, L. L., Brooks, B. W., Chambliss, C. K. (2009). Occurrence of pharmaceuticals and personal care products in fish: results of a national pilot study in the United States. Environmental Toxicology and Chemistry 28(12):2587-2597.		
HERO ID:		5428006		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is present
	Metric 2:	Analytical Methodology	Medium	method detection limit included but full methods description is in another publication
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	US
	Metric 5:	Currency	Medium	2006
	Metric 6:	Spatial and Temporal Variability	High	18-24 from each site
	Metric 7:	Exposure Scenario	High	the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	mean and max
	Metric 9:	Quality Assurance	High	No QA/QC issues have been identified which significantly interfere with the overall reliability of the study
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	discusses factors that explain variability.
Overall Quality Determination			High	

Study Citation: Ramos, S., Homem, V., Santos, L. (2019). Simultaneous determination of synthetic musks and UV-filters in water matrices by dispersive liquid-liquid microextraction followed by gas chromatography tandem mass-spectrometry. Journal of Chromatography A 1590:47-57.

HERO ID: 5428034

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	Section 2.2; sampling methodology discussed briefly; all samples centrifuged before extraction
Metric 2:	Analytical Methodology	High	USA-DLLME-GC-MS/MS; Section 2.3 and 2.4; LOD and LOQ Table 2
Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness			
Metric 4:	Geographic Area	High	Section 2.2 - Portugal
Metric 5:	Currency	High	June 2017
Metric 6:	Spatial and Temporal Variability	Critically Deficient	sample size not reported
Metric 7:	Exposure Scenario	Medium	river, sea and tap water, influent and effluent wastewater; says naturally contaminated samples
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Low	Table 4 provides concentration and SD per matrix; p. 56 discussion
Metric 9:	Quality Assurance	High	Section 2.5; blanks; corrected sample concentrations; Table 3 recoveries
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Medium	Variability and uncertainty were not clearly discussed

Overall Quality Determination

Uninformative

Study Citation:		Reiner, J. L., Kannan, K. (2011). Polycyclic Musks in Water, Sediment, and Fishes from the Upper Hudson River, New York, USA. Water, Air, and Soil Pollution 214(1-4):335-342.		
HERO ID:		5428036		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is present
	Metric 2:	Analytical Methodology	High	The analytical methodology is present
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	upper Hudson River in eastern New York State
	Metric 5:	Currency	Medium	2006
	Metric 6:	Spatial and Temporal Variability	Low	1 to 2 samples for each site and each species
	Metric 7:	Exposure Scenario	High	the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	single numbers provided for n = 1 and n=2. replicates included. Unclear what the single values in table 1 represent
	Metric 9:	Quality Assurance	Medium	QA could be better detailed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	seems like standard error should be included
Overall Quality Determination			Medium	

Study Citation:		Ramos, S., Homem, V., Santos, L. (2019). Development and optimization of a QuEChERS-GC-MS/MS methodology to analyse ultraviolet-filters and synthetic musks in sewage sludge. Science of the Total Environment 651(Pt 2):2606-2614.		
HERO ID:		5428039		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Section 2.2; grab samples
	Metric 2:	Analytical Methodology	High	QuEChERS-GC-MS/MS; LOD and LOQ Table 4
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Oporto, Portugal
	Metric 5:	Currency	High	December 2013-December 2017
	Metric 6:	Spatial and Temporal Variability	Medium	7 sewage sludge samples from one WWTP
	Metric 7:	Exposure Scenario	High	A WWTP that serves a population of 80,000 inhabitants
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Table 5 provides concentration and SD in sludge samples; concentrations per sampling event and means per season
	Metric 9:	Quality Assurance	High	blanks; corrected sample concentrations; mean recoveries in Table 4
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Section 3.4; low variability with seasons; small samples size but align with literature
Overall Quality Determination			High	

Study Citation:		Reiner, J. L., Berset, J. D., Kannan, K. (2007). Mass flow of polycyclic musks in two wastewater treatment plants. Archives of Environmental Contamination and Toxicology 52(4):451-457.		
HERO ID:		5428045		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling methodology is present, though could benefit from additional detail
	Metric 2:	Analytical Methodology	High	The analytical methodology is present
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	two plants in moderately populated city in NY State
	Metric 5:	Currency	Medium	October 16-20, 2005
	Metric 6:	Spatial and Temporal Variability	Medium	24 hr composite samples; daily collection between the 16th to 20th (5 days)
	Metric 7:	Exposure Scenario	High	the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	concentrations sampled per day (individual samples), mean, SD; no DF or percentiles
	Metric 9:	Quality Assurance	High	recoveries and blanks run with samples discussed in QC section
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	discusses uncertainties p. 453; compares concentrations to other studies
Overall Quality Determination			High	

Study Citation:		Relic, D., Popovic, A., Dordevic, D., Caslavsky, J. (2017). Occurrence of synthetic musk compounds in surface, underground, waste and processed water samples in Belgrade , Serbia. Environmental Earth Sciences 76(3):1-10.		
HERO ID:		5428046		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling methodology is present, though could benefit from additional detail (pg 3/10)
	Metric 2:	Analytical Methodology	High	The analytical methodology is present, though could benefit from additional detail
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Territory of Belgrade
	Metric 5:	Currency	Medium	March 2014
	Metric 6:	Spatial and Temporal Variability	Low	Low samples (<5)
	Metric 7:	Exposure Scenario	High	the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Could be better presented (Table 2, Fig 3)
	Metric 9:	Quality Assurance	Low	poor description of quality assurance
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability and uncertainty were not clearly discussed
Overall Quality Determination			Medium	

Study Citation:		Ricking, M., Schwarzbauer, J., Hellou, J., Svenson, A., Zitko, V. (2003). Polycyclic aromatic musk compounds in sewage treatment plant effluents of Canada and Sweden - first results. Marine Pollution Bulletin 46(4):410-417.		
HERO ID:		5428047		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is present
	Metric 2:	Analytical Methodology	Medium	detection limits in range of 0.5 ng/l; no attempt to quantify with concentrations less than 1 ng/l
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	different wastewater treatment effluents in Canada and Sweden
	Metric 5:	Currency	Low	January 2002 (Canada) and June-December 1999 (Sweden)
	Metric 6:	Spatial and Temporal Variability	Low	see sections 3.1 and 3.2 for discussion of samples; exact number of samples not clear - may be unacceptable; replicates used
	Metric 7:	Exposure Scenario	High	the exposure scenarios assessed are relevant to HHCb’s TSCA risk evaluation
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	single concentration per location provided; DF=1.0; no variance or tendency
	Metric 9:	Quality Assurance	Low	blanks and replicates used; compared to other studies
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	compared with published data
Overall Quality Determination			Medium	

Study Citation:		Ribeiro, H., Ramos, S., Homem, V., Santos, L. (2017). Can coastline plant species be used as biosamplers of emerging contaminants? - UV-filters and synthetic musks as case studies. Chemosphere 184(Elsevier):1134-1140.		
HERO ID:		5428048		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Limited description; SI might provide additional information.
	Metric 2:	Analytical Methodology	High	QuEchERS extraction technique described and validated; ion-trap GC/MS
	Metric 3:	Biomarker Selection	N/A	Plants as biomonitors of chemical in environment (absorption from air), not biomarker of animal or human exposures.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Portugal coast
	Metric 5:	Currency	High	2016, March
	Metric 6:	Spatial and Temporal Variability	Medium	42 plant samples (15 beaches across two areas, 1 to 5 plant species per beach, triplicate extractions per plant).
	Metric 7:	Exposure Scenario	Low	Coastal plants as passive biomonitors of chemical in air along coastal communities; relationship to air concentrations not explored.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Mean, SD, LOQ, n = 3 extractions per plant. Data 15 locations presented individually.
	Metric 9:	Quality Assurance	High	Described; special precautions to prevent sample contamination; triplicate extractions, %RSD, LOD, linearity.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Discussed factors likely to result in temporal and spatial variation.
Overall Quality Determination			Medium	

Study Citation:		Saraiva, M., Cavaleiro, J., Lanceleur, L., Monperrus, M. (2016). Synthetic musk in seafood products from south Europe using a quick, easy, cheap, effective, rugged and safe extraction method. Food Chemistry 200:330-335.		
HERO ID:		5428073		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is present
	Metric 2:	Analytical Methodology	High	MDLs provided
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Spain, Portugal, France
	Metric 5:	Currency	Medium	2011-2014
	Metric 6:	Spatial and Temporal Variability	Low	12 samples over 7 locations - no sample type and sampling site repeated.
	Metric 7:	Exposure Scenario	High	the exposure scenarios assessed are relevant to HHCB's TSCA risk evaluation
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Table 4
	Metric 9:	Quality Assurance	Low	quality not disussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not clearly discussed
Overall Quality Determination			Medium	

Study Citation:		Sang, W., Zhang, Y., Zhou, X., Zhang, T. C. (2012). Spatial and seasonal distribution of synthetic musks in sewage treatment plants of Shanghai, China. Water Science and Technology 66(1):201-209.		
HERO ID:		5428083		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is present
	Metric 2:	Analytical Methodology	High	LODs in Table 2
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Shanghai
	Metric 5:	Currency	Medium	2008-2009
	Metric 6:	Spatial and Temporal Variability	Low	3 samples per water type, per treatment plant
	Metric 7:	Exposure Scenario	Low	non-occupational exposures to influent, effluent and landfilled sludge is not common
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Table 3 reports individual data points
	Metric 9:	Quality Assurance	Low	recovery and LOQs reported. Controls not discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	not discussed
Overall Quality Determination			Medium	

Study Citation:		Shek, W. M., Murphy, M. B., Lam, J. C. W., Lam, P. K. S. (2008). Polycyclic musks in green-lipped mussels (<i>Perna viridis</i>) from Hong Kong. Marine Pollution Bulletin 57(6-12):373-380.		
HERO ID:		5428089		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is present
	Metric 2:	Analytical Methodology	High	DL in text
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Hong Kong
	Metric 5:	Currency	Low	2004
	Metric 6:	Spatial and Temporal Variability	Medium	15 replicates made a composite sample, which was divided into 5 analytical replicates for 9 sites
	Metric 7:	Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	one composite sample per site - evaluated 5x
	Metric 9:	Quality Assurance	High	No QA/QC issues have been identified which significantly interfere with the overall reliability of the study
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not clearly discussed
Overall Quality Determination			Medium	

Study Citation:		Moldovan, Z., Schmutzer, G., Tusa, F., Calin, R., Alder, A. C. (2007). An overview of pharmaceuticals and personal care products contamination along the river Somes watershed, Romania. Journal of Environmental Monitoring 9(9):986-993.		
HERO ID:		5428090		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	grab samples
	Metric 2:	Analytical Methodology	Medium	SPE; GC-ITMS; LOQ ranged from 2.5 - 37 ng/L; no SI
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	river Somes in NW Romania
	Metric 5:	Currency	Low	September 2006
	Metric 6:	Spatial and Temporal Variability	Low	15 sampling sites along the river; 5 WWTPs; grab samples in September
	Metric 7:	Exposure Scenario	High	Somes river receives wasts from urban areas, factories, and WWTPs
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 3 provides concentrations and SD for every site (upstream and downstream); Table 4 provides concentrations for the different WWTP effluents
	Metric 9:	Quality Assurance	Medium	recoveries varied between 55-110%
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability and uncertainty were not clearly discussed
Overall Quality Determination			Medium	

Study Citation:		Musolff, A., Leschik, S., Möder, M., Strauch, G., Reinstorf, F., Schirmer, M. (2009). Temporal and spatial patterns of micropollutants in urban receiving waters. Environmental Pollution 157(11):3069-3077.		
HERO ID:		5428096		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	grab samples for WWTP from inflow and effluent; surface water grab samples from center of watercourses; gw sampled using submerged pumps following German DVWK protocol; collected in glass bottles; stored in dark and cool places
	Metric 2:	Analytical Methodology	High	SPE then GC-MS; external standard mixture measured every 5 analyses to check instrumental performance; LOD and recovery reported in Table 1
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Leipzig, eastern part of Germany
	Metric 5:	Currency	Medium	April 2007 to April 2008
	Metric 6:	Spatial and Temporal Variability	High	1 WWTP; 6 surface water sampling sites; 22 groundwater sites; sampling covered the different seasons as well as different flow conditions in surface water and complemented with sampling every month at selected critical points; 13 WWTP inflow samples; 13 WWTP effluent samples; 33 samples from sw; 60 samples of gw
	Metric 7:	Exposure Scenario	High	urban watershed; river affected by several WWTP plants
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	concentration mean, median, standard deviation, outliers, and extremes as well as normality of distribution in the different water compartments; HHCB detected in all samples; Fig 2 shows concentrations in untreated and treated wastewater, surface water, and gw
	Metric 9:	Quality Assurance	Medium	recovery rate 100%; concentrations log-normalized to ensure normality and linear relationship; no QA/QC section
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	discusses variability in results section; discusses outliers
Overall Quality Determination			High	

Study Citation:		Mottaleb, M. A., Usenko, S., O'Donnell, J. G., Ramirez, A. J., Brooks, B. W., Chambliss, C. K. (2009). Gas chromatography-mass spectrometry screening methods for select UV filters, synthetic musks, alkylphenols, an antimicrobial agent, and an insect repellent in fish. Journal of Chromatography A 1216(5):815-823.		
HERO ID:		5428105		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	sampling described elsewhere
	Metric 2:	Analytical Methodology	High	LODs identified. Methodology was detailed and no major deficiencies were identified.
	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	Texas
	Metric 5:	Currency	Low	No Sampling date provided. Sampling described elsewhere: A.J. Ramirez, M.A. Mottaleb, B.W. Brooks, C.K. Chambliss, Anal. Chem. 79 (2007)3155.
	Metric 6:	Spatial and Temporal Variability	High	11 and 20 samples from 2 sites
	Metric 7:	Exposure Scenario	Medium	The data represent relevant exposure scenarios.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	individual concentrations in fish in Table 3
	Metric 9:	Quality Assurance	Medium	The study applied quality assurance/quality control measures and all pertinent quality assurance information is provided in the data source or companion source.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	didn't discuss variability. But did mention that the results in this paper differed from previous analyses published for these samples.
Overall Quality Determination			Medium	

Study Citation:		Osenbrück, K., Gläser, H. R., Knöller, K., Weise, S. M., Möder, M., Wennrich, R., Schirmer, M., Reinstorf, F., Busch, W., Strauch, G. (2007). Sources and transport of selected organic micropollutants in urban groundwater underlying the city of Halle (Saale), Germany. Water Research 41(15):3259-3270.		
HERO ID:		5428132		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	surface water (river, STP outflow, and small brook) - grab samples from middle of river; gw (main aquifers) - submersible pump after exchanging water column of wells at least two times before sampling; stored in cooled containers; filtered
	Metric 2:	Analytical Methodology	Medium	SPE; GC-MS; gw LOD = 0.2 ng/L LOQ 0.6 ng/L; surface water samples usually one order of magnitude higher, but these not provided; recovery ranged from 75-100%
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	City of Halle (Saale), Germany
	Metric 5:	Currency	Medium	2002 to 2006
	Metric 6:	Spatial and Temporal Variability	High	main aquaifer (10 sampling sites); tertiary aquifer (2 sampling sites); Triassic and Permian aquifers (3 sites) and 1 river (188 samples) and 1 sewage treatment plant (7 samples); surface water 13 sampling campaigns 2002 to 2005 then 12 campaigns from 2005 to 2006 during low flow conditions; gw sampled 2 campaigns in 2004 and 2005 and more frequently at four sites during 2005 and 2006
	Metric 7:	Exposure Scenario	High	urban setting - Sections 2.1 and 2.2
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	median concentrations in each gw, sw, and STP effluent presented in Table 1 and Fig 2
	Metric 9:	Quality Assurance	Low	recovery ranged from 75-100%; analytical method protocol previously given in detail in other study (Einsle 2006)
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	variation discussed some in results section
Overall Quality Determination			Medium	

Study Citation:		Pintado-Herrera, M. G., Lara-Martín, P. A., González-Mazo, E., Allan, I. J. (2016). Determination of silicone rubber and low-density polyethylene diffusion and polymer/water partition coefficients for emerging contaminants. Environmental Toxicology and Chemistry 35(9):2162-2172.		
HERO ID:		5428155		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Page 2164 "Field study"; silicone rubber passive samplers 21-d deployment of replicate samplers in the River Alna; duplicate strips deployed using stainless steel canisters; below water surface and parallel to water flow.
	Metric 2:	Analytical Methodology	Medium	Passive sampling with silicone rubber and LDPE; p.2164 "Extraction and analysis"; liquid-liquid extraction; recovery over 70% (Table S1); GC-MS; LOD 0.03-1.44 ng/mL; further details in SI.
	Metric 3:	Biomarker Selection	N/A	Testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected in Alna River (Oslo, Norway).
	Metric 5:	Currency	Medium	Samples collected in July 2013.
	Metric 6:	Spatial and Temporal Variability	Low	The authors used a passive sampler for 3 weeks; replicate samples; not clear on sample size; more information may be in SI.
	Metric 7:	Exposure Scenario	High	Alna River, small urban river flowing through Oslo.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 2 provides concentrations in the river - 170 ng/L; contaminate concentrations provided in SI (Section S5, Fig S3).
	Metric 9:	Quality Assurance	High	Field control samples were used; recoveries >70%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	discussed some p. 2170; explains why HHCB found in both preparation and field control samplers; levels found in present study align with previous studies;
Overall Quality Determination			Medium	

Study Citation:		Li, A. J., Feldman, S. M., McNally, R. K., Kannan, K. (2019). Distribution of organohalogen and synthetic musk compounds in breast adipose tissue of breast cancer patients in Ulster County, New York, USA. Archives of Environmental Contamination and Toxicology 77(1):68-78.		
HERO ID:		5428185		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is present
	Metric 2:	Analytical Methodology	High	The analytical methodology is present
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Ulster County, New York, USA
	Metric 5:	Currency	Low	samples collected 1996-1998
	Metric 6:	Spatial and Temporal Variability	Medium	> 10 samples, no replicates
	Metric 7:	Exposure Scenario	High	the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	no raw data
	Metric 9:	Quality Assurance	High	No QA/QC issues have been identified which significantly interfere with the overall reliability of the study
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variability and uncertainty were clearly discussed
Overall Quality Determination			High	

Study Citation:		Kwon, J. W., Rodriguez, J. M. (2014). Occurrence and removal of selected pharmaceuticals and personal care products in three wastewater-treatment plants. Archives of Environmental Contamination and Toxicology 66(4):538-548.		
HERO ID:		5428197		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	grab samples collected between 10 and 11am; samples filtered
	Metric 2:	Analytical Methodology	Medium	liquid-liquid extraction; GC-MS; recovery tests run in triplicate; calibration curves; recoveries and LOQ ranges discussed p.542
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Mississippi; cities not named but described
	Metric 5:	Currency	Medium	November 2011 to September 2012
	Metric 6:	Spatial and Temporal Variability	High	3 WWTPs (influent and effluent; n=81); down and upstream (n=15 near WWTPs A and C; n=27 for WWTP B); n provided in Tables 3 and 4; surface water samples collected during turbulent flows; sampled during a 1 yr period
	Metric 7:	Exposure Scenario	High	3 WWTPs with different treatment technologies (Table 1 provides characteristics of each) and surface water upstream and downstream of each WWTP
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 3 provides range, mean, median and DF of influent and effluent of all three WWTPs combined throughout the year; Table 4 provides mean and SD upstream and downstream of each WWTP; raw data not provided and no SI
	Metric 9:	Quality Assurance	High	recovery tests run in triplicate; ranged from 72.47 to 104.7% for all chemicals tested;
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	SD provided; some discussion of variation, seasonal variation; compares to previous studies; further investigation need for upstream samples of WWTP A to explain high concentrations
Overall Quality Determination			High	

Study Citation:		Lee, H. B., Peart, T. E., Sarafin, K. (2003). Occurrence of polycyclic and nitro musk compounds in Canadian sludge and wastewater samples. Water Quality Research Journal of Canada 38(4):683-702.		
HERO ID:		5428198		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	grab samples; pulverized sludge samples stored in jars at room temp; 24-h composite sample of influent, effluent, and industrial wastewater extracted; water samples filtered; discussion and details limited
	Metric 2:	Analytical Methodology	Medium	SFE using supercritical carbon dioxide extraction of sludge; liquid-liquid extraction of water samples; GC/MS; Table 3 provides recovery and LOD of water and sludge samples; replicate analysis (n=4)
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Various cities in Canada (See Tables 4, 5 and 6)
	Metric 5:	Currency	Low	1996 - 2002 (See Tables 4, 5 and 6)
	Metric 6:	Spatial and Temporal Variability	Low	27 sludge samples from 19 sewage treatment plants; influent/effluent samples from 6 cities; 13 wastewater samples from industrial facilities; single to a few samples per site/facility
	Metric 7:	Exposure Scenario	High	type of samples or facilities identified in Tables 4-6
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	raw data provided in Tables 4-6
	Metric 9:	Quality Assurance	High	high recovery data Table 3; replicate analyses
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	limited discussion of variations; no discussion of uncertainties, limitations, data gaps
Overall Quality Determination			Medium	

Study Citation:		Lange, C., Kuch, B., Metzger, J. W. (2015). Occurrence and fate of synthetic musk fragrances in a small German river. Journal of Hazardous Materials 282(Elsevier):34-40.		
HERO ID:		5428206		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is present
	Metric 2:	Analytical Methodology	Low	LOQ range in text
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Germany
	Metric 5:	Currency	Medium	2010-2011
	Metric 6:	Spatial and Temporal Variability	High	12 water samples per site; 251 fish caught at 14 sites
	Metric 7:	Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	digitization of graphs needed
	Metric 9:	Quality Assurance	Low	not discussed, but controls were performed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	not discussed
Overall Quality Determination			Medium	

Study Citation:		Lou, Y. H., Wang, J., Wang, L., Shi, L.,ei, Yu, Y.,ue, Zhang, M. Y. (2016). Determination of Synthetic Musks in Sediments of Yellow River Delta Wetland, China. Bulletin of Environmental Contamination and Toxicology 97(1):78-83.		
HERO ID:		5428251		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	no details on equipment or procedure; sediment samples dried in a vacuum freeze dryer for at least 48 h; samples then crushed and sieved; stored at -20C
	Metric 2:	Analytical Methodology	High	extracted using HEX/DCM; GC-MS; 3 parallel samples tested for each site to assess and correct instrumental errors; LOW 0.05 and LOQ 0.17 ng/g (Table 1); recoveries used
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	National Nature Reserve; Yellow River Delta wetland, China
	Metric 5:	Currency	Medium	November 2014
	Metric 6:	Spatial and Temporal Variability	Medium	24 sediment sample sites - 20 along the river and 4 along the old course of the river; sampling only in November
	Metric 7:	Exposure Scenario	High	Yellow river second largest in China; more info on p. 79
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	individual sample concentrations presented in Table 2; range, mean presented in text on p. 80
	Metric 9:	Quality Assurance	High	good recovery (91.85-105.35%)for all chemicals; corrected for instrumental errors
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	relative standard deviation ranged from 3.30 to 8.11% for all chemicals; compared findings to other studies
Overall Quality Determination			High	

Study Citation:		Liu, N., Shi, Y., Li, W., Xu, L., Cai, Y. (2014). Concentrations and distribution of synthetic musks and siloxanes in sewage sludge of wastewater treatment plants in China. Science of the Total Environment 476-477(Elsevier):65-72.		
HERO ID:		5428263		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	collected at the dewatering process, packed in aluminumfoil and sealed in polypropylene bags; freeze-dried, homogenized and stored at -20C
	Metric 2:	Analytical Methodology	Medium	extracted with HEX/DCM; GC/MS; LOD and LOQ probably reported in Table S1
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	WWTPs in 23 cities in China (see Fig 1)
	Metric 5:	Currency	Medium	October 2010 to March 2011
	Metric 6:	Spatial and Temporal Variability	Low	42 sewage sludge samples from different WWTP in 23 cities; number of samples per WWTP not specified; may be from single space in time (not specified)
	Metric 7:	Exposure Scenario	High	sludge from WWTP in 23 cities, most in relatively developed provinces in China (see Table 1)
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	raw data not provided; discussion does not indicate data in SI; Section 3.1 discusses results and Fig 3 provides box and whisler concentration plot showing median and 25th and 75th percentiles; DF=95%; range <LOQ to 41.4 ug/g; mean 3.52 ug/g
	Metric 9:	Quality Assurance	High	Section 2.4; recoveries were good (55-107%); blank samples
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Section 3.1 compares to previous studies and attributed large variability to different consumption patterns in different areas and countries
Overall Quality Determination			Medium	

Study Citation:		Lu, B., Feng, Y., Gao, P., Zhang, Z. (2013). Occurrence and distribution of polycyclic musks in surface water from the Songhua River. Advanced Materials Research 726-731:1508-1511.		
HERO ID:		5428264		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	collected in December from 9 study areas along river; stored in pre-cleaned amber glass jars and kept at 4C; samples filtered
	Metric 2:	Analytical Methodology	Medium	p. 1509; SPE; GC/MS; duplicate samples; MDL ranged from 1-2ng/L
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Songhua River, Heilongjiang valley in NE China
	Metric 5:	Currency	Medium	December, 2012
	Metric 6:	Spatial and Temporal Variability	Medium	9 study sites along river sampled in December
	Metric 7:	Exposure Scenario	High	largest tributary in NE China; commercial fisheries; is a water supply, irrigation, tourism, recreation, and conservation value
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	no SI; concentrations ranged from 6.77-30.65 ng/L; Fig 1 depicts total concentration by sampling site; number of samples per sampling site not provided
	Metric 9:	Quality Assurance	High	blanks and duplicate samples; mean recoveries higher than 70%
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	relative std ranged from 5.41-15.52%; compared concentrations to previously reported studies from other countries and within China
Overall Quality Determination			Medium	

Study Citation:		Hájková, K., Pulkrabová, J., Hajslová, J., Randák, T., Zlábek, V. (2007). Chub (Leuciscus cephalus) as a bioindicator of contamination of the Vltava River by synthetic musk fragrances. Archives of Environmental Contamination and Toxicology 53(3):390-396.		
HERO ID:		5428325		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is present
	Metric 2:	Analytical Methodology	High	The analytical methodology is present
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Vltava River, Prague
	Metric 5:	Currency	Medium	2005
	Metric 6:	Spatial and Temporal Variability	High	12 samples at 2 sites
	Metric 7:	Exposure Scenario	High	the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	summary data: mean and SD
	Metric 9:	Quality Assurance	Medium	recovery, repeatability, LOQ reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	not discussed
Overall Quality Determination			High	

Study Citation:		Heberer, T. (2003). Occurrence, fate, and assessment of polycyclic musk residues in the aquatic environment of urban areas - A review. Acta Hydrochimica et Hydrobiologica 30(5-6):227-243.		
HERO ID:		5428326		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	N/A	Not original report; N = 324 fish samples between 1996 and 1998.
	Metric 2:	Analytical Methodology	N/A	Not original publication of data.
	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	Low	1996 and 1998
	Metric 6:	Spatial and Temporal Variability	Low	Different fish species and areas across Berlin; description minimal.
	Metric 7:	Exposure Scenario	Medium	Ecological: fish as receptors and bioaccumulation in aquatic food chain.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	N, mean, median, max, 95th percentile, and N> LOQ reported.
	Metric 9:	Quality Assurance	N/A	Not original publication of data.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	N/A	Not original publication of data.
Overall Quality Determination			Medium	

Study Citation:	Mitjans, D., Ventura, F. (2005). Determination of fragrances at ng/L levels using CLSA and GC/MS detection. Water Science and Technology 52(10-11):145-150.			
HERO ID:	5428328			
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	sampling methodology only briefly discussed p. 149
	Metric 2:	Analytical Methodology	High	CLSA-GC-MS; LOD 6 ng/l (Table 2)
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	from Belgium, Germany, France, Spain
	Metric 5:	Currency	Low	May 2003
	Metric 6:	Spatial and Temporal Variability	Low	sampling from 4 countries (see Table 4); 6 WWTPs; 4 surface waters and rivers; 4 drinking water sites; taken in May
	Metric 7:	Exposure Scenario	Low	Table 4 does not indicate where, besides the type and country, samples collected
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	concentration per site provided in Table 4; HHCb detected in all WWTP samples; summary statistics missing
	Metric 9:	Quality Assurance	High	mean recovery 99% from the different source samples
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	method gave good repeatability and reproducibility; no discussion to real world samples
Overall Quality Determination			Low	

Study Citation:		Herren, D., Berset, J. D. (2000). Nitro musks, nitro musk amino metabolites and polycyclic musks in sewage sludges - Quantitative determination by HRGC-ion-trap-MS/MS and mass spectral characterization of the amino metabolites. Chemosphere 40(5):565-574.		
HERO ID:		5428331		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	sewage sludges from different catchment areas; pre-cleaned glass bottles stored at 4C and extracted next day; samples filtered; no other discussion/details
	Metric 2:	Analytical Methodology	Low	SPE; HRGC and MS/MS, detection limits 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	Switzerland
	Metric 5:	Currency	Low	sampling date no provided; published in 2000
	Metric 6:	Spatial and Temporal Variability	Low	7 samples for A-type sewage; 3 samples for B-type; and 2 for C-type; does not specify timing or locations
	Metric 7:	Exposure Scenario	Medium	sewer systems A, B, and C briefly described in Section 2.2
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	raw data reported in Table 4; summary stats not reported; no SI
	Metric 9:	Quality Assurance	Medium	mean recovery rate for water 114%, in sewage sludge not spiked; blank samples
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	no discussion
Overall Quality Determination			Low	

Study Citation:		Hutter, H. P., Wallner, P., Moshammer, H., Hartl, W., Sattelberger, R., Lorbeer, G., Kundi, M. (2009). Synthetic musks in blood of healthy young adults: relationship to cosmetics use. Science of the Total Environment 407(17):4821-4825.		
HERO ID:		5428336		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	High—Sampling methodology, equipment, procedures, sample storage at -20C and storage duration of less than seven days prior to analysis of all samples described for blood samples collected from 114 students attending courses at the Hygiene Institute of Medical University of Vienna, Austria.
	Metric 2:	Analytical Methodology	High	High—Analytical methods described, with additional details noted as reported within previous study (Hutter et al., 2005). Details on analytical instrumentation (GC/MS), extraction methods, chemical-specific LOD (62.0 ng/L) and LOQ's (124.0 ng/L), and recovery rate (95.1%) in Table 1.
	Metric 3:	Biomarker Selection	N/A	N/A—Sampling for parent chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	High—Vienna, Austria
	Metric 5:	Currency	Low	Low—Dates of sampling not reported within text or referenced (Hutter et al., 2005) study.
	Metric 6:	Spatial and Temporal Variability	Medium	Medium—Single blood sample collected from 114 students, with 83 samples >LOQ for analysis of HHCB.
	Metric 7:	Exposure Scenario	High	High—Additional information potential exposure sources such as use of lotions, perfumes, deodorants, shampoo, fragrance oils, air freshener sprays, consumption of fish frequency, as well as body surface area, measured height, measured weight, BMI, and measured subscapular skinfold thickness and demographics gathered through interview at time of sampling, reported and analyzed in relation to category of polycyclic or nitro-musk serum concentrations.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Medium—Results of analysis of 83 blood sample concentrations >LOQ reported with only median (420 ng/L reported in text) and maximum concentration (4100 ng/L, Table 4). Authors noted detailed HHCB concentrations reported within referenced study (Hutter et al., 2005), which include reported concentrations summarized as median and quartile 1- quartile 3 concentrations across questionnaire demographic and exposure source covariates.
	Metric 9:	Quality Assurance	Medium	Medium—Quality assurance and control measures noted as including laboratory analysis blanks and recovery data. Insufficient information on correction for blank recoveries. Authors reported results of duplicate analysis of single sample as method reproducibility.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Low—Limited characterization of variability (HHCB concentration data only presented as median and maximum). Authors discussed possible reasoning for results of regression analyses with predicted weighted sum plasma polycyclic musk concentrations in relation to demographics. Lack of discussion of potential limitations and uncertainties. Comparison of concentration results within this study to those reported for sampling during the 1990's stated as a main objective, however 1990's concentration data not reported, and only qualitative (higher/lower) comparisons briefly mentioned within text with no statistical comparisons conducted.
Overall Quality Determination			Medium	

Study Citation:		Hu, Z., Shi, Y., Niu, H., Cai, Y., Jiang, G., Wu, Y. (2010). Occurrence of synthetic musk fragrances in human blood from 11 cities in China. Environmental Toxicology and Chemistry 29(9):1877-1882.		
HERO ID:		5428337		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Medium—Details on sampling equipment, sampling procedures, sample storage at -20C, and study site in terms of city/province location and sampling month/year reported. Insufficient information regarding duration of sample storage prior to analysis.
	Metric 2:	Analytical Methodology	Medium	Medium—Details regarding extraction method, analytical instrumentation (GC/MS-EI), instrument calibration, LOD, recovery samples reported. Insufficient information on matrix (lipid) adjustment.
	Metric 3:	Biomarker Selection	N/A	N/A—Sampling for parent chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	High—Sampling within eleven cities/provinces in China: Harbin, Qingdao, Huhhot, Chongqing, Chengdu, Lanzhou, Kunming, Guiyang, Ningbo, Shijiazhuang, and Changsha.
	Metric 5:	Currency	Medium	Medium—Sampling conducted between November 2007 and May 2008.
	Metric 6:	Spatial and Temporal Variability	Medium	Medium—A total of 204 participants provided single blood samples for analysis within a study designed to understand the geographical patterns of synthetic musk fragrances in China. Insufficient information on number of samples provided within each province.
	Metric 7:	Exposure Scenario	Medium	Medium—Population providing samples described in terms of demographics of age, weight, gender and location of sampling. Concentration results presented by age group and gender. Insufficient information on occupation, use of relevant consumer products of participants.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Medium—Summary statistics reported within box and whisker plots with median, minimum, maximum, interquartile range of concentrations and outliers presented. HHCB (Galaxolide) noted as detected in 98% of samples. Insufficient information on number of samples within each province.
	Metric 9:	Quality Assurance	Medium	Medium—Quality assurance with regards to laboratory recovery range, field blanks within each city/province and laboratory blank analysis information reported. Insufficient information on blank correction.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Low—Concentration variability illustrated within box and whisker plots. Authors noted reported HHCB concentrations to be higher than in previous studies. Demographic (age, gender, body weight) and lifestyle (smoking, fish consumption) data obtained through self-report. Authors noted that information on fish consumption habits was not clear, but further details not provided. Insufficient information on these or other potential limitations lacking.
Overall Quality Determination			Medium	

Study Citation:		Hu, Z., Shi, Y., Cai, Y. (2011). Reprint of: Concentrations, distribution, and bioaccumulation of synthetic musks in the Haihe River of China. Chemosphere 85(2):262-267.		
HERO ID:		5428338		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	transportation and storage not well described
	Metric 2:	Analytical Methodology	Medium	SI available for method details
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Tianjin City
	Metric 5:	Currency	Medium	2008
	Metric 6:	Spatial and Temporal Variability	Medium	23 water, 13 sediment from 23 sites; 7 and 10 fish from 2 sites
	Metric 7:	Exposure Scenario	High	the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	bar graphs; summary data in text
	Metric 9:	Quality Assurance	Medium	see SI for details
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability and uncertainty were not clearly discussed
Overall Quality Determination			Medium	

Study Citation:		Hutter, H. P., Wallner, P., Moshammer, H., Hartl, W., Sattelberger, R., Lorbeer, G., Kundi, M. (2005). Blood concentrations of polycyclic musks in healthy young adults. Chemosphere 59(4):487-492.		
HERO ID:		5428345		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Medium—Sampling methodology discussed in terms of sampling equipment, sample storage conditions. Insufficient information on sample storage duration.
	Metric 2:	Analytical Methodology	High	High—Analytical methods described, with additional details noted as reported within previous study (Hutter et al., 2005). Details on analytical instrumentation (GC/MS), extraction methods, chemical-specific LOD (62.0 ng/L) and LOQ's (124.0 ng/L), and recovery rate (95.1%) in Table 1.
	Metric 3:	Biomarker Selection	N/A	N/A—Sampling for parent chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	High—Vienna, Austria.
	Metric 5:	Currency	Low	Dates of sampling not reported within text. Published in 2005
	Metric 6:	Spatial and Temporal Variability	Medium	Medium—Single blood sample collected from 114 students, with 83 samples >LOQ for analysis of HHCB.
	Metric 7:	Exposure Scenario	High	High—Additional information potential exposure sources such as use of lotions, perfumes, deodorants, shampoo, fragrance oils, air freshener sprays, consumption of fish frequency, as well as body surface area, height, weight, BMI, and subscapular skinfold thickness and demographics gathered within questionnaires reported and analyzed in relation to HHCB concentrations (Table 3).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Medium—Results of analysis of 83 blood sample concentrations >LOQ reported concentrations summarized as maximum concentration (text), median and quartile 1- quartile 3 (Table 3) concentrations across questionnaire demographic and exposure source covariates. Insufficient information regarding raw data results.
	Metric 9:	Quality Assurance	Medium	Medium—Quality assurance and control measures noted as including laboratory analysis blanks and recovery data. Insufficient information on correction for blank recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Medium—Characterization of variability within presentation of quartile concentrations, and authors note HHCB concentrations similar to those analyzed within previous studies. Authors discuss potential reasoning for gender differences in HHCB concentrations. Discussion of limitations and uncertainties lacking. Results of regression analysis with predictors of HHCB concentration only reported qualitatively within text without reporting of beta coefficients (95 % confidence intervals).

Overall Quality Determination

Medium

Study Citation:		Hijosa-Valsero, M., Reyes-Contreras, C., Domínguez, C., Bécares, E., Bayona, J. M. (2016). Behaviour of pharmaceuticals and personal care products in constructed wetland compartments: Influent, effluent, pore water, substrate and plant roots. Chemosphere 145:508-517.		
HERO ID:		5428347		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The analytical methodology is present
	Metric 2:	Analytical Methodology	Low	Lack of analytical methodology discussion. "Details of the sample handling, the preparation process and the chromatographic conditions can be found in the Supplementary Material (analytical methods)."
	Metric 3:	Biomarker Selection	N/A	Chemical is measured in environmental media
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	facilities of the Leon WWTP, in the northwest of Spain
	Metric 5:	Currency	Medium	Sampling occurred during the summer of 2010
	Metric 6:	Spatial and Temporal Variability	Low	No replicate samples
	Metric 7:	Exposure Scenario	Medium	No use of exposure controls.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual data points are not reported.
	Metric 9:	Quality Assurance	Low	No direct discussion on quality assurance/control techniques
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Lacks discussion of limitations
Overall Quality Determination			Medium	

Study Citation:		Hu, Z., Shi, Y., Zhang, S., Niu, H., Cai, Y. (2011). Assessment of synthetic musk fragrances in seven wastewater treatment plants of Beijing, China. Bulletin of Environmental Contamination and Toxicology 86(3):302-306.		
HERO ID:		5428350		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	sampling methodology discussed p.303; 24 h composite samples; filtered sewage and freeze-dried homogenized sludge; stored at -20C
	Metric 2:	Analytical Methodology	High	SPE for sewage; ASE for sludge; GC-MS; standard calibration performed; LOD 3.3 ng/g for sludge and 1.2 ng/l for sewage; recovery studies carried out
	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	January 15, May 28, and September 24, 2008
	Metric 6:	Spatial and Temporal Variability	High	45 samples (17 influent, 15 effluent, 12 sludge) collected from 7 municipal WWTP; sampling performed in three seasons; 24 h composite samples at each sampling time
	Metric 7:	Exposure Scenario	Medium	WWTPs in Beijing which is in northern China, is second largest city and capital; densely populated; description and location of each the 7 municipal WWTP within Beijing not discussed or depicted
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Fig 1 depicts concentrations total samples collected in influent in different season and effluent in different seasons; sludge data not presented; Results discussion on p.304 provides some statistics; influent ranged 30.9-3,038.97 ng/L; effluent 30.4-685.62 ng/L; DF 100% in sludge with range of 0.26-12.59 ng/kg dw
	Metric 9:	Quality Assurance	Medium	recoveries ranged from 83.6 - 105.1%; procedure blanks and field blanks
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	RSD ranged from 3.2 to 9.8%; compared results from this study to previous studies within China as well as other countries
Overall Quality Determination			Medium	

Study Citation:		Kannan, K., Reiner, J. L., Yun, S. H., Perrotta, E. E., Tao, L., Johnson-Restrepo, B., Rodan, B. D. (2005). Polycyclic musk compounds in higher trophic level aquatic organisms and humans from the United States. Chemosphere 61(5):693-700.		
HERO ID:		5428378		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is present
	Metric 2:	Analytical Methodology	Low	LOQ was set to twice the concentration found in blanks. But values not provided
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	various locations
	Metric 5:	Currency	Low	1997-2003
	Metric 6:	Spatial and Temporal Variability	High	Males n=12; females n=37
	Metric 7:	Exposure Scenario	High	The exposure scenarios assessed are relevant to HHCB's TSCA risk evaluation
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The results are well presented but could use additional clarification
	Metric 9:	Quality Assurance	Medium	No QA/QC issues have been identified which significantly interfere with the overall reliability of the study though QA/QC could be better detailed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability and uncertainty were not fully discussed
Overall Quality Determination			Medium	

Study Citation:		Jiang, S., Wang, L., Zheng, M., Lou, Y., Shi, L. (2018). Determination and environmental risk assessment of synthetic musks in the water and sediments of the Jiaozhou Bay wetland, China. Environmental Science and Pollution Research 25(5):4915-4923.		
HERO ID:		5428379		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Described in moderate detail.
	Metric 2:	Analytical Methodology	Medium	Preparation of water and sediment samples described. Analysis with GC/MS and EI described in moderate detail.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China, Jiaozhou Bay wetlands
	Metric 5:	Currency	Medium	March 2014
	Metric 6:	Spatial and Temporal Variability	Medium	Spatial variation: 18 locations along Dagu River, 18 sediment and 14 surface water samples (4 dry locations); temporal variation not evaluated. Three sediment replicates per location; 3 water samples per location - but combined into 1 composite water sample.
	Metric 7:	Exposure Scenario	Medium	Ecological receptors: wetland flora and fauna.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Range, mean, % detect reported in text. Individual surface water samples in Table 2 and sediment samples in Table 3. LOD & LOQ in Table 1.
	Metric 9:	Quality Assurance	High	Clean; sample blanks below LOD for chemical; linear calibration; % recoveries, %RSD, LOQ, LOD.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Discussed possible causes for spatial variation; did not evaluate temporal variation. QA described possible measurement uncertainty.
Overall Quality Determination			Medium	

Study Citation:		Gómez, M. J., Herrera, S., Solé, D., García-Calvo, E., Fernández-Alba, A. R. (2012). Spatio-temporal evaluation of organic contaminants and their transformation products along a river basin affected by urban, agricultural and industrial pollution. Science of the Total Environment 420(Elsevier):134-145.		
HERO ID:		5428380		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Locations and dates reported; storage and transport reported.
	Metric 2:	Analytical Methodology	Medium	Stir bar sorptive extraction (SBSE) followed by 2-D GC (GCxGC-TOF-MS) described briefly (see Gomez et al. 2011 for more details and validation: HERO 2168797).
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Spain
	Metric 5:	Currency	Medium	2010
	Metric 6:	Spatial and Temporal Variability	Medium	Spatial: One WWTP effluent and 5 river sampling locations, 3 upstream and 2 downstream of WWTP. Temporal: 6 different sampling days between April and June 2010.
	Metric 7:	Exposure Scenario	Low	Ecological receptors high; human receptors low.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Mean, range, MQL, and % detection listed separately for 5 locations (6 samples from different days at each location).
	Metric 9:	Quality Assurance	Medium	Measured values from blanks subtracted from samples. QA procedures described in Gomez et al. 2011.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Attempted to evaluate both spatial and temporal variability. Analytic uncertainties addressed for galaxolide lactone in Figure 3.
Overall Quality Determination			Medium	

Study Citation:		Jenkins, J. A., Rosen, M. R., Draugelis-Dale, R. O., Echols, K. R., Torres, L., Wieser, C. M., Kersten, C. A., Goodbred, S. L. (2018). Sperm quality biomarkers complement reproductive and endocrine parameters in investigating environmental contaminants in common carp (Cyprinus carpio) from the Lake Mead National Recreation Area. Environmental Research 163:149-164.		
HERO ID:		5428384		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling methodology is present, though could benefit from additional detail other papers cited for methods This metric is not applicable
	Metric 2:	Analytical Methodology	Low	
	Metric 3:	Biomarker Selection	N/A	
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Lake Mead National Recreation Area 1999–2006 seems to be a single composite sample for each location. The study was conducted in 1999–2006 and may not represent current exposures
	Metric 5:	Currency	Medium	
	Metric 6:	Spatial and Temporal Variability	Low	
	Metric 7:	Exposure Scenario	Medium	
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	one value of a composite sample QA not discussed in sufficient details
	Metric 9:	Quality Assurance	Low	
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not clearly discussed
Overall Quality Determination			Low	

Study Citation:		Kallenborn, R., Gatermann, R., Planting, S., Rimkus, G. G., Lund, M., Schlabach, M., Burkow, I. C. (1999). Gas chromatographic determination of synthetic musk compounds in Norwegian air samples. Journal of Chromatography A 846(1-2):295-306.		
HERO ID:		5428385		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling methodology is present, though could benefit from additional detail
	Metric 2:	Analytical Methodology	Medium	The analytical methodology is present, though could benefit from additional detail
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study location is Norway
	Metric 5:	Currency	Low	The study was conducted in 1997
	Metric 6:	Spatial and Temporal Variability	Medium	The number of scenario specific samples is between 5-10
	Metric 7:	Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	The results are well presented and sufficiently clear
	Metric 9:	Quality Assurance	High	No QA/QC issues have been identified which significantly interfere with the overall reliability of the study
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not clearly discussed
Overall Quality Determination			Medium	

Study Citation:	Kinney, C. A., Furlong, E. T., Kolpin, D. W., Burkhardt, M. R., Zaugg, S. D., Werner, S. L., Bossio, J. P., Benotti, M. J. (2008). Bioaccumulation of pharmaceuticals and other anthropogenic waste indicators in earthworms from agricultural soil amended with biosolid or swine manure. Environmental Science & Technology 42(6):1863-1870.			
HERO ID:	5428388			
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling Methodology	High	The Sampling methodology is described in detail in the main report and supplemental file
	Metric 2:	Analytical Methodology	Low	Samples were below the statistically calculated method detection limit based on previous publications
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness	Metric 4:	Geographic Area	High	The study location is Midwestern United States
	Metric 5:	Currency	Medium	The study was conducted in 2005
	Metric 6:	Spatial and Temporal Variability	Low	3 sites each with soil and worm on 2 different dates
	Metric 7:	Exposure Scenario	Medium	The assessment is more related to the ecological assessment of HHCB in earthworms, though there is some relevance to the general population exposures
Domain 3: Accessibility/Clarity	Metric 8:	Reporting of Results	High	Results reported in Tables 1-2
	Metric 9:	Quality Assurance	Low	Details regarding quality insurance are reported in the supplemental information file; although, Samples were below the statistically calculated method detection limit based on previous publications
Domain 4: Variability and Uncertainty	Metric 10:	Variability and Uncertainty	Medium	A more thorough discussion of variability and uncertainty would be useful especially ragarding uncertainties with the limits of detection
Overall Quality Determination			Medium	

Study Citation:		Kameda, Y., Kimura, K., Miyazaki, M. (2011). Occurrence and profiles of organic sun-blocking agents in surface waters and sediments in Japanese rivers and lakes. Environmental Pollution 159(6):1570-1576.		
HERO ID:		5428390		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Characteristics of sampling sites relative to sources is well explained.
	Metric 2:	Analytical Methodology	High	Well described for water and sediment samples; LOD probably reported in Supplemental Information (SI).
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Japan, Saitama rivers and lakes (near Tokyo)
	Metric 5:	Currency	Medium	2008, September and August
	Metric 6:	Spatial and Temporal Variability	Medium	Water and sediment samples from: 5 background sites; 12 moderately polluted rivers, 6 heavily polluted rivers, 4 STP effluents, and 2 streams.
	Metric 7:	Exposure Scenario	High	Rivers and streams: ecological receptors.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Freq. of detection, mean, and range of measured concentrations reported. SI might have more information.
	Metric 9:	Quality Assurance	High	Appears high; details in SI.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Spatial variation evaluated; temporal not. Focus on sun-blocking chemicals; HHCB used as "indicator" chemical - uncertainties not discussed.
Overall Quality Determination			High	

Study Citation:		Kinney, C. A., Furlong, E. T., Kolpin, D. W., Zaugg, S. D., Burkhardt, M. R., Bossio, J. P., Werner, S. L. (2010). Earthworms: Diagnostic indicators of wastewater derived anthropogenic organic contaminants in terrestrial environments. ACS Symposium Series Volume 1048 1048:297-317.		
HERO ID:		5428395		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The biosolid, soil and earthworm sampling methodology were described in detail.
	Metric 2:	Analytical Methodology	Low	The analytical methods were described, mentioning recoveries, instrumentation and LOD, but the values for recoveries and LOD were not reported.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Data collected in Midwestern U.S.
	Metric 5:	Currency	Medium	The samples were collected in 2005.
	Metric 6:	Spatial and Temporal Variability	Low	n=10 (no replicates), estimated from Table II.
	Metric 7:	Exposure Scenario	Medium	The data may represent chemical presence in soil and earthworms evaluated in biosolid amended soils and other soils. The limited sample size limits the results' generalizability.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table II has raw data for each site (average of 3 replicate composite samples). Summary statistics were reported.
	Metric 9:	Quality Assurance	High	QA/QC techniques were described in detail.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was not characterized. Uncertainties and limitations were not discussed.
Overall Quality Determination			Medium	

Study Citation:		Cunha, S. C., Trabalón, L., Jacobs, S., Castro, M., Fernandez-Tejedor, M., Granby, K., Verbeke, W., Kwadijk, C., Ferrari, F., Robbens, J., Sioen, I., Pocurull, E., Marques, A., Fernandes, J. O., Domingo, J. L. (2018). UV-filters and musk fragrances in seafood commercialized in Europe Union: Occurrence, risk and exposure assessment. Environmental Research 161:399-408.		
HERO ID:		5428404		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling is described in the methods.
	Metric 2:	Analytical Methodology	Low	Table 2 includes LOD and LOQ however, HHCB is not included in the table. The SI may include HHCB.
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Europe - species consumed in Europe.
	Metric 5:	Currency	High	Study was done from 2014-2015.
	Metric 6:	Spatial and Temporal Variability	High	In each sampling site, at least 25 specimens per species were sampled and pooled, reaching a minimum of 800 g of edible tissue. 62 total samples were evaluated.
	Metric 7:	Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 4 includes average, range, and frequency.
	Metric 9:	Quality Assurance	Medium	Recovery and repeatability are included in Table 2, but HHCB is not included in Table 2. Check the SI.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not discussed with regard to the monitoring. Both are discussed in the modeling.
Overall Quality Determination			Medium	

Study Citation:		Den Hond, E., Paulussen, M., Geens, T., Bruckers, L., Baeyens, W., David, F., Dumont, E., Loots, I., Morrens, B., de Bellevaux, B. N., Nelen, V., Schoeters, G., Van Larebeke, N., Covaci, A. (2013). Biomarkers of human exposure to personal care products: results from the Flemish Environment and Health Study (FLEHS 2007-2011). Science of the Total Environment 463-464:102-110.		
HERO ID:		5428405		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Medium—Sampling equipment and procedures at schools for adolescents described as adhering to standard methods with blood samples frozen within one day. Insufficient additional information on sample storage time prior to analysis.
	Metric 2:	Analytical Methodology	High	High—Methodology for sample extraction, analytical instrumentation (GC-MS), chemical-specific LOD (0.016 ug/L) and adjustment for serum lipids within multivariate analyses described. Insufficient information on instrument calibration and recovery, however authors note additional laboratory details provided within SI.
	Metric 3:	Biomarker Selection	N/A	N/A—Sampling for parent chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	High—Flanders, Belgium
	Metric 5:	Currency	Medium	Medium—Sampling conducted between May of 2008 and May of 2009.
	Metric 6:	Spatial and Temporal Variability	Medium	Medium—Blood sampling results for 204 adolescents. Single blood samples for each participant, however authors note use of “recent exposure” information on consumer product use during the last three days prior to blood sampling for more accurate timing of sampling in relation to product use information. Authors note use of systematic, stratified clustered multi-stage design in selecting participants as a random sample of the population.
	Metric 7:	Exposure Scenario	High	High—Non-occupational (adolescent) population sampled described in terms of demographics, dates of sampling, source of exposure in terms of consumer personal care product use, and exposure controls in terms of low product use category.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Medium—Summary statistics for N=204 HHCB adolescent blood level geometric mean, 95% CI, medium, quartile 1-quartile 3, P90, and minimum-maximum concentrations reported. Population demographics, location (Flanders, Belgium) and dates of sampling reported. Detection frequency described as greater than 91%. Insufficient information regarding tests for outliers and raw data.
	Metric 9:	Quality Assurance	Medium	Medium—Quality Assurance and control described as following standard QA/QC procedures for laboratory analyses. Authors noted all samples were handled, frozen and stored within one day. Authors noted lipid-adjustment within multivariate analyses. Insufficient information on QA/QC details such as recoveries, blank or control sampling.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Low—Variability characterized within summary statistics and coefficients of variation. Authors note low adolescent blood HHCB inter-individual variability. Discussion of study limitations (self-reported personal product use without validation) lacking.
Overall Quality Determination			Medium	

Study Citation:		Dsikowitzky, L., Schwarzbauer, J., Littke, R. (2002). Distribution of polycyclic musks in water and particulate matter of the Lippe River (Germany). Organic Geochemistry 33(12):1747-1758.		
HERO ID:		5428412		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Authors did not provide details regarding the sampling equipment for sediment collection.
	Metric 2:	Analytical Methodology	High	Authors provided information on extraction method, analytical instrumentation, calibration, percent recoveries, and the limit of quantification for water and sediment measurements.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected from the Lippe River, North-Rhine Westphalia, Germany and the authors include a figure showing a map of the area.
	Metric 5:	Currency	Low	Samples were collected in 1999.
	Metric 6:	Spatial and Temporal Variability	High	High score selected for sediment and surface water because sample size was 19, however the score for wastewater influent/effluent is low because only 2 samples were collected.
	Metric 7:	Exposure Scenario	High	The authors described the surrounding area and reviewed river runoff data as well.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	The authors present the individual sample concentrations for surface water, wastewater, and sediment in Tables 2 and 4, however they do not present any summary statistics for any media.
	Metric 9:	Quality Assurance	Medium	It is unclear if the blank analyses were laboratory blanks only. It does not appear they collected field blanks/control samples.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No measurement of variation is reported. The authors do touch on some limitations of the study in the discussion section.
Overall Quality Determination			Medium	

Study Citation:		Foltz, J., Abdul Mottaleb, M., Meziani, M. J., Rafiq Islam, M. (2014). Simultaneous detection and quantification of select nitromusks, antimicrobial agent, and antihistamine in fish of grocery stores by gas chromatography-mass spectrometry. Chemosphere 107:187-193.		
HERO ID:		5428439		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Analytical methodology was well described with minimal issues identified.
	Metric 2:	Analytical Methodology	High	Analytical methodology was well described.
	Metric 3:	Biomarker Selection	N/A	Measured chemical in fish samples
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Maryville, Missouri
	Metric 5:	Currency	Low	Timing of sample collection for monitoring data is not reported, discussed, or referenced. Published in 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	Medium = 5-10 samples for a single scenario
	Metric 7:	Exposure Scenario	Medium	The data closely represent relevant exposure scenario.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Good presentation of results provided.
	Metric 9:	Quality Assurance	High	Discussed in section 2.7.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some discussion of variability and uncertainty.
Overall Quality Determination			Medium	

Study Citation:		Fromme, H., Otto, T., Pilz, K. (2001). Polycyclic musk fragrances in different environmental compartments in Berlin (Germany). Water Research 35(1):121-128.		
HERO ID:		5428446		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is presented starting on page 121
	Metric 2:	Analytical Methodology	High	Analytical methodology is sufficiently described, including analytical instrumentation
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Thstudy location is Berlin, Germany
	Metric 5:	Currency	Low	The study was conducted from 1996-1997
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates are presented
	Metric 7:	Exposure Scenario	Medium	While the exposure scenarios assessed are relevant to HHCB’s TSCA risk evaluation, exposures from the study location are not likely to represent exposures in the US population to due varying sources of HHCB and product usage patterns accross countries and/or regions
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Min, median, max data are presented in Tables 4-7
	Metric 9:	Quality Assurance	Medium	While discussed to some degree, a presentation of quality assurance could have been more thorough and clear, though no QA/QC issues have been identified which significantly interfere with the overall reliability of the study
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not clearly discussed
Overall Quality Determination			Medium	

Study Citation:		Fromme, H., Otto, T., Pilz, K. (2001). Polycyclic musk fragrances in fish samples from Berlin waterways, Germany. Food Additives and Contaminants 18(11):937-944.		
HERO ID:		5428450		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is dscribed in detail on page 938
	Metric 2:	Analytical Methodology	High	The analytical methodology is dscribed in detail on page 939
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study location is Berlin, Germany
	Metric 5:	Currency	Low	the study was conducted from 1996-1997
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates were reported
	Metric 7:	Exposure Scenario	High	While the exposure scenarios assessed in this study are generally relevant to HHCB's TSCA risk evaluation, the study was conducted in Germany amount and patterns of exposure likely do note represent US exposures as the distribution of sources of exposure accross countries are expected to differ
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Individual data points in scatter plot are presented in Fig 2
	Metric 9:	Quality Assurance	Low	blanks and controls were not discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not clearly discussed
Overall Quality Determination			Medium	

Study Citation:		Gao, Q., Blum, K. M., Gago-Ferrero, P., Wiberg, K., Ahrens, L., Andersson, P. L. (2019). Impact of on-site wastewater infiltration systems on organic contaminants in groundwater and recipient waters. Science of the Total Environment 651(Pt. 2):1670-1679.		
HERO ID:		5428453		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Groundwater monitoring wells were used by local authority for routine monitoring; grab samples were collected and stored at -20C; the samples were filtered.
	Metric 2:	Analytical Methodology	High	Discussion included SPE, GC/HRMS or LC-MS/MS. LOD and LOQs listed in Table S3 and recovery rates in Table S4 and S7, which were all >40%.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected in Are municipality (Storlien and Ann) in central Sweden.
	Metric 5:	Currency	High	Samples collected from November 2016-August 2017.
	Metric 6:	Spatial and Temporal Variability	Medium	There were 5 sampling seasons (see Table 1), and at 2 sites - Storlien, 4 groundwater sampling points (n=20). The 4 sampling points are considered replicates. At 2 lakes (n=4) - Ann, 2 groundwater sampling points (n=10); stream water (n=2) and lake (n=2) sampled in June and August.
	Metric 7:	Exposure Scenario	High	The exposure scenario was ground water and surface water in residential Are municipality; more details provided in Table S1.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data was reported in SI; Fig 2 and Fig 5 depicted concentrations; summary statistics were limited in the paper but SI may provide additional detail.
	Metric 9:	Quality Assurance	Medium	Section 2.4 discussed QA/QC; recovery > 40%; additional information in SI.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Paper discusses seasonal variation and compares levels to literature and previous studies.
Overall Quality Determination			High	

Study Citation:		Che, J., Yu, R., Song, Q., Wang, L.,iP, Wu, S. F. (2011). Determination of synthetic musks in the sediment of the Taihu lake by using accelerated solvent extraction (ASE) and GC/MS. International Journal of Environmental Analytical Chemistry 91(4):387-399.		
HERO ID:		5428483		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	homogenized, stored at -20C, ground to pass through a sieve
	Metric 2:	Analytical Methodology	High	ASE and GC/MS; recovery samples; LOD 0.030 ng/g; LOQ 0.10 ng/g
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Taihu Lake, located between Jiangsu and Zhejiang Province, China
	Metric 5:	Currency	Medium	2009
	Metric 6:	Spatial and Temporal Variability	Medium	15 sediment location along Taihu Lake (Fig 2); only sampled June 14-15
	Metric 7:	Exposure Scenario	High	largest freshwater lake in China; serves population of 34,000,000
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1 lists concentration per sample site; HHCB detected in all samples; ranged from 0.336-3.10 ng/g; other summary statistics not detailed
	Metric 9:	Quality Assurance	High	Section 2.6; recovery 104%; blanks
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	RSD ranged from 0.5-6.9%, indicating acceptable repeatability; compared concentrations to other studies in China and Great Lakes
Overall Quality Determination			High	

Study Citation:		Chen, D., Zeng, X., Sheng, Y., Bi, X., Gui, H., Sheng, G., Fu, J. (2007). The concentrations and distribution of polycyclic musks in a typical cosmetic plant. Chemosphere 66(2):252-258.		
HERO ID:		5428484		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology is presented in Section 2.2
	Metric 2:	Analytical Methodology	High	Analytical methodology is sufficiently described, including analytical instrumentation (Section 2.4)
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The air, wastewater and sludge samples were collected from a typical cosmetic plant in the HuangPu industrial park in GuangZhou, China
	Metric 5:	Currency	Low	Samples were collected in 2004
	Metric 6:	Spatial and Temporal Variability	Low	Sample size per scenario is less than 5
	Metric 7:	Exposure Scenario	Medium	while environmental exposures to HHCB as presented in this study are relevant generally to the HHCB TSCA risk evaluation, since this study was conducted in China it is unlikely that the exposures from that location is representative of the US, mainly due to varying product usage patterns accross regions and populations
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	The results are presented in Tables 4-6
	Metric 9:	Quality Assurance	High	No QA/QC issues have been identified which significantly interfere with the overall reliability of the study.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study is missing a robust discussion of potential uncertainties and varaibilities
Overall Quality Determination			Medium	

Study Citation:		Guo, G. H., Wu, F. C., He, H. P., Zhang, R. Q., Li, H. X. (2013). Screening level ecological risk assessment for synthetic musks in surface water of Lake Taihu, China. Stochastic Environmental Research and Risk Assessment 27(1):111-119.		
HERO ID:		5428490		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	sampling locations Fig 1; detailed sampling information in SI
	Metric 2:	Analytical Methodology	High	water samples were extracted using C-18 discs and detected on gas chromatography mass spectrometry; detailed information listed 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	Lake Taihu, China
	Metric 5:	Currency	Low	2009
	Metric 6:	Spatial and Temporal Variability	Medium	33 samples from 3 bay's of Lake Taihu; June -September; more information probably in SI
	Metric 7:	Exposure Scenario	High	large amounts of industrial, agricultural, and municipal wastewater have been discharged into the lake, which is larges freshwater lake in China
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Table 2 provides range, means and SDs; SI may have raw data but not specified; Fig 3 provides interquartile ranges
	Metric 9:	Quality Assurance	Low	not discussed; recoveries may be provided in SI
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	some comparison with other studies
Overall Quality Determination			Medium	

Study Citation:		Guo, R., Lee, I. S., Kim, U. J., Oh, J. E. (2010). Occurrence of synthetic musks in Korean sewage sludges. Science of the Total Environment 408(7):1634-1639.		
HERO ID:		5428491		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	dewatered sludge, 1 - 4 L, freeze dried, crushed, homogenized and sieved; details on STPs Table 1
	Metric 2:	Analytical Methodology	High	ASE; GC/MS; LOD 7 ng/g; LOQ ng/g (Table 2)
	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; cities not specified
	Metric 5:	Currency	Medium	2008
	Metric 6:	Spatial and Temporal Variability	High	sampling done September 11-October 14; 13 municipal WWTPs, 4 livestock and 1 pharmaceutical WWTP
	Metric 7:	Exposure Scenario	High	dewatered sludge; 13 municipal WWTPs, 4 livestock and 1 pharmaceutical WWTP; Table 1 provides details of each plant
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Table 3 provides concentrations per location; range 0.52 - 82.0 mg/kg dw, mean 31.2 mg/kg
	Metric 9:	Quality Assurance	High	Section 2.6; recoveries 97% for spiked blanks and 85% for spiked matrix
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	compared with previous studies;
Overall Quality Determination			High	

Study Citation:		Chen, F., Ying, G., Ma, Y.,iB, Chen, Z., Lai, H., Peng, F. J. (2014). Field dissipation and risk assessment of typical personal care products TCC, TCS, AHTN and HHCB in biosolid-amended soils. Science of the Total Environment 470:1078-1086.		
HERO ID:		5428493		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is presented in detail starting in Sectuion 2
	Metric 2:	Analytical Methodology	Medium	Extraction procedure was optimized from previous studies (Taoet al., 2002; Liu et al., 2011).
	Metric 3:	Biomarker Selection	N/A	Chemical measured in soil and not as biomarkers
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study location is China as presented in Table 3
	Metric 5:	Currency	Medium	Sampling occurred 2010-2011
	Metric 6:	Spatial and Temporal Variability	Low	Sample size not listed in the running text. Table 1 lists n=4
	Metric 7:	Exposure Scenario	Medium	While the exposures to HHCB in consumer products is relevant to the HHCB TSCA risk evaluation, the study is conducted in China and associated exposures may not be relevant to the US
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No individual data points listed
	Metric 9:	Quality Assurance	Medium	No control sample
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited discussion of uncertainties
Overall Quality Determination			Medium	

Study Citation:		Clara, M., Gans, O., Windhofer, G., Krenn, U., Hartl, W., Braun, K., Scharf, S., Scheffknecht, C. (2011). Occurrence of polycyclic musks in wastewater and receiving water bodies and fate during wastewater treatment. Chemosphere 82(8):1116-1123.		
HERO ID:		5428501		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Specifics not discussed.
	Metric 2:	Analytical Methodology	High	GC-MS. SI provides data on LOD and LOQ for 14 WWTPs (varied among WWTPs, matrix effects).
	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	Austria
	Metric 5:	Currency	Low	Sampling year not listed in report; presumably between 2002 and 2010. Data compared to other studies dating from 2002 through 2010. Published in 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	14 WWTP sampled; however only two samples (pooled into one) taken per WWTP. Temporal variation not examined.
	Metric 7:	Exposure Scenario	Medium	Concentration in WWTP influents and then effluents to surface water.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Data for 14 different WWTPs presented; data for only 2 receiving rivers.
	Metric 9:	Quality Assurance	Low	Not really discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Temporal variation not addressed; 14 different WWTP but only 3 investigated in detail; no significant trends with location noted; WWTP did remove most of HHCB (difference between influent and effluent concentrations).
Overall Quality Determination			Medium	

Study Citation:		Chen, F., Ying, G. G., Ma, Y. B., Chen, Z. F., Lai, H. J. (2014). Field dissipation of four personal care products in biosolids-amended soils in North China. Environmental Toxicology and Chemistry 33(11):2413-2421.		
HERO ID:		5428509		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The authors detail the sampling equipment, procedure, and storage conditions. They also provide information on the study site.
	Metric 2:	Analytical Methodology	Medium	The authors reported the extraction method and analytical methods. The recoveries and LODs were referenced as being in the supplemental information, and there were no calibration methods or results reported.
	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 describe the geographic area where the study was conducted.
	Metric 5:	Currency	Medium	Samples were collected in 2010 and 2011.
	Metric 6:	Spatial and Temporal Variability	Medium	The methods state that five subsamples were collected from each plot starting in October 2010, and collected monthly until October 2011 with exception of January and February 2011. There were a total of 10 plots, four old experimental plots, two old control plots, one new control plot and three new experimental plots. The authors did not seem to take replicate samples.
	Metric 7:	Exposure Scenario	Medium	These were experimental fields where biosolids was being applied over time. The plots were well described by the authors including the soil characteristics.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No summary statistics for soil samples were provided and only one time point of concentration data was reported in the main text. The authors refer to the supplemental information which likely contains the sample concentrations measured over time. Maximum biosolid concentrations were reported but no other metrics.
	Metric 9:	Quality Assurance	Medium	Authors reported reagent blank, method blank, duplicate, and spiked matrix were analyzed together with the biosolids and soil samples. The experiment also included control plots as a comparison to the experimental plots. Recoveries were not reported in the main article but in the supporting information. No information about results of laboratory blanks were reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No standard deviation or measure of variance was reported. The study has limited discussion of key uncertainties, limitations, and data gaps.
Overall Quality Determination			Medium	

Study Citation:		Corada-Fernández, C., Candela, L., Torres-Fuentes, N., Pintado-Herrera, M. G., Paniw, M., González-Mazo, E. (2017). Effects of extreme rainfall events on the distribution of selected emerging contaminants in surface and groundwater: The Guadalete River basin (SW, Spain). Science of the Total Environment 605-606:770-783.		
HERO ID:		5428556		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Section 2.2 presents the sampling methodology in detail
	Metric 2:	Analytical Methodology	High	Analytical methodology is well described, including analytical instrumentation, in the supplemental file
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The sampling location is Guadalete River basin (SW, Spain)
	Metric 5:	Currency	Medium	Data collected between 2007 to 2010
	Metric 6:	Spatial and Temporal Variability	Medium	Sampling sizes were at least 5 but replicates not evident
	Metric 7:	Exposure Scenario	Medium	While the exposures assessed is generally of relevance to the HHCB TSCA risk evaluation, since the study was conducted in another country it is unclear whether the exposures from the study can be reasonably expected to represent those of the US
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	See Tables 3, 4
	Metric 9:	Quality Assurance	High	No QA/QC issues have been identified which significantly interfere with the overall reliability of the study
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No limitations clearly reported
Overall Quality Determination			High	

Study Citation:		Blum, K. M., Haglund, P., Gao, Q., Ahrens, L., Gros, M., Wiberg, K., Andersson, P. L. (2018). Mass fluxes per capita of organic contaminants from on-site sewage treatment facilities. Chemosphere 201(Elsevier):864-873.		
HERO ID:		5428638		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The water sampling methodology was described in detail and is scientifically sound.
	Metric 2:	Analytical Methodology	High	The analytical methods were thoroughly described, including LOD and recoveries.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed water samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in Sweden.
	Metric 5:	Currency	Medium	The samples were collected in 2014 and 2015.
	Metric 6:	Spatial and Temporal Variability	Low	There were 20 samples in total from five locations (4 replicates).
	Metric 7:	Exposure Scenario	High	The data closely represent relevant exposure scenarios related to contaminants of interest in River Fyris, which receives treated sewage.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Summary statistics and individual sample concentrations were reported.
	Metric 9:	Quality Assurance	High	QA/QC techniques were reported, including the use of control samples.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variability was characterized (IQR, range). Uncertainties were discussed by the authors.
Overall Quality Determination			High	

Study Citation:		Bester, K. (2004). Retention characteristics and balance assessment for two polycyclic musk fragrances (HHCB and AHTN) in a typical German sewage treatment plant. Chemosphere 57(8):863-870.		
HERO ID:		5428639		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	sampled every 2 h and mixed to ive 24h composite samples; influent taken after mechanical grid chamber; effluent after final settlement and before introduction to river; stored at 4C and extracted within 4 h; unfiltered; sludge samples as single grab sample (solid) on same days as water samples; obtained from loading of trucks
	Metric 2:	Analytical Methodology	High	water samples - liquid/liquid extraction; GC–MS; calibration performed; recovery samples; LOQ 100 ng/L (Table 1) for water samples and 5 ng/g for sludge; lyophilisation and successive Soxhlet extraction for sludge
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Dortmund, Germany
	Metric 5:	Currency	Low	2002
	Metric 6:	Spatial and Temporal Variability	Medium	April 8-12 (five 24 hr samples); double samples for each day; sampled during dry season
	Metric 7:	Exposure Scenario	High	STP processing wastewater of about 350,000 inhabitants as well as industry (brewing); half the wastewater that is processed is domestic
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 3 provides the average per day of influent, effluent and sludge samples as well as the overall mean and SD;
	Metric 9:	Quality Assurance	High	recoveries reported in Tables 1 and 2; 75% for influent/effluent and 100% for sludge; three replica extractions at 5 different concentrations; blanks samples
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	compared data with published studies; discusses flow variation; day to day standard variation of 240 ng/g; main variabilities and uncertainties stem from discontinuous sludge dewatering
Overall Quality Determination			High	

Study Citation:		Blanco, M., Fernandes, D., Rizzi, J., Huertas, D., Caiola, N., Fernández, P., Porte, C. (2018). The combined use of chemical and biochemical markers in <i>Rutilus rutilus</i> to assess the effect of dredging in the lower course of the Ebro River. <i>Ecotoxicology and Environmental Safety</i> 155:9-16.		
HERO ID:		5428640		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	details in SI
	Metric 2:	Analytical Methodology	Low	MDL and MQL range provided
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Ebor River, Spain
	Metric 5:	Currency	Medium	2012-2013
	Metric 6:	Spatial and Temporal Variability	Medium	n=5-9; no replicates
	Metric 7:	Exposure Scenario	Medium	While exposures to HHCB via surface water are relevant to the HHCB TSCA risk evaluation, the study was conducted in Spain and associated exposures to HHCB may not represent US exposures
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	summary data in bar graphs
	Metric 9:	Quality Assurance	Low	Not directly discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	variability is discussed
Overall Quality Determination			Medium	

Study Citation:		Blanco, M., Rizzi, J., Fernandes, D., Colin, N., Maceda-Veiga, A., Porte, C. (2019). Assessing the impact of waste water effluents on native fish species from a semi-arid region, NE Spain. Science of the Total Environment 654:218-225.		
HERO ID:		5428644		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sample collection methodology is presented in Section 2.2
	Metric 2:	Analytical Methodology	Low	No DL was reported
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study location is Spain
	Metric 5:	Currency	Medium	The sampling was done in 2012
	Metric 6:	Spatial and Temporal Variability	Medium	no replicates; n = 6-10
	Metric 7:	Exposure Scenario	Medium	While the assessment of the impact of waste water effluents onnative fishspecies is of relevance to the HHCB TSCA risk evaluation, since the study was conducted in a foreign country exposures from such sources may not represent US based exposures
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Results are presented through figures 2-5 though raw data were not presented as well
	Metric 9:	Quality Assurance	Low	Quality assurance was not directly discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not clearly discussed
Overall Quality Determination			Medium	

Study Citation:		Bester, K., Huhnerfuss, H., Lange, W., Rimkus, G. G., Theobald, N. (1998). Results of non target screening of lipophilic organic pollutants in the German Bight II: Polycyclic musk fragrances. Water Research 32(6):1857-1863.		
HERO ID:		5428648		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	100 L water samples at 5 m depth; condensed to 0.1 ml after fractionation
	Metric 2:	Analytical Methodology	High	NP-HPLC; VG-Tribrid GC-MS System; PFTBA (perfluorotributylamin) was used for the mass calibration; LOD 0.04 ng/L Table 1
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	German Bight of the North Sea
	Metric 5:	Currency	Low	1990 and 1995
	Metric 6:	Spatial and Temporal Variability	High	7 stations; 1001 water samples during June 1990 and June-July 1995
	Metric 7:	Exposure Scenario	High	Fig 4 depicts rivers Elbe, Weser, and Ems as well as city of Breman and the sampling area; "Discussion and Conclusions" sections discusses the setting
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 2 provides concentrations per sample station by year; raw data not provided; no summary stats
	Metric 9:	Quality Assurance	High	recovery rate 87%; not corrected; blanks
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	compare to other studies and changes between years
Overall Quality Determination			High	

Study Citation:		Bester, K. (2005). Polycyclic musks in the Ruhr catchment area–transport, discharges of waste water, and transformations of HHCB, AHTN and HHCB-lactone. Journal of Environmental Monitoring 7(1):43-51.		
HERO ID:		5428650		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The authors provide details about the sample collection of the surface and wastewater samples. They also mentioned storage conditions and study site characteristics.
	Metric 2:	Analytical Methodology	High	The authors report the extraction method, analytical instrumentation and performed instrument calibration. The also reported recovery rates of 75-100% and LOQs in Table 2.
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The authors describe the study area and provide a map (Figure 2).
	Metric 5:	Currency	Low	Samples were collected prior to 2005.
	Metric 6:	Spatial and Temporal Variability	High	Based on Table 4, the total number of wastewater samples collected was 223. They were taken at varying points along the Ruhr River.
	Metric 7:	Exposure Scenario	High	The exposure scenario of wastewater samples in a river is of interest to OPPT.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	No raw concentration data was provided in the study. The concentration data is described in the text but mostly displayed in figures, making it difficult to extract the data. The authors report the range for HHCB in the text but do not report frequency of detection or standard deviation. It is also unclear if Table 4 presents average concentrations. Authors use words like "typical concentrations" which it is unclear if they mean an average or median concentration.
	Metric 9:	Quality Assurance	High	The authors reported using field blanks and analytical blanks. The field blanks were all below the limit of detection. The LOQs were determined based on the analytical blanks and the measured concentrations in the analytical blanks were reported. The authors reported the recoveries to be between 75-100%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The authors also collected samples from other rivers as a comparison. They also collected samples along the river for comparison at different points. Standard deviations were not reported.
Overall Quality Determination			Medium	

Study Citation:		Beretta, M., Britto, V., Tavares, T. M., da Silva, S. M. T., Pletsch, A. L. (2014). Occurrence of pharmaceutical and personal care products (PPCPs) in marine sediments in the Todos os Santos Bay and the north coast of Salvador, Bahia, Brazil. Journal of Soils and Sediments 14(7):1278-1286.		
HERO ID:		5428652		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling equipment and procedures not fully described.
	Metric 2:	Analytical Methodology	High	Analytical methodology well described.
	Metric 3:	Biomarker Selection	N/A	Sampling in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected in the Todos os Santos Bay, Brazil.
	Metric 5:	Currency	Low	Sampling date not reported. Publication date is 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	Samples were collected from 17 sites along the coast of a bay. All samples collected in the same time period with no replicates.
	Metric 7:	Exposure Scenario	High	Setting and potential sources well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data is reported.
	Metric 9:	Quality Assurance	High	Quality control measures were applied and no issues were identified.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Minimal analysis of variability and uncertainty.
Overall Quality Determination			High	

Study Citation: Carlos, G., Nicola, S., Leire, A., Sonia, P., Gustavo, F., Trish, F., Roy, L., James, R. (2007). Pharmaceuticals, personal care products, endocrine disrupters, fragrances and faecal steroids in sewage effluents, riverine, estuarine and coastal waters. :648-652.

HERO ID: 5428728

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling Methodology	Medium	The authors report the study site characteristics, sampling equipment, procedures, and storage conditions. They did not given a lot of detail about the sampling sites.
Metric 2:	Analytical Methodology	Low	The authors discussed the extraction method, analytical instrumentation, but did not discuss calibration or recovery samples and they did not report any LOQ or LOD.
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 describe the geographical area where the study took place.
Metric 5:	Currency	Medium	The samples were collected between 2006-2007.
Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size was not reported by the authors. The authors reported collecting triplicate field samples but no total sample size was provided.
Metric 7:	Exposure Scenario	Medium	The authors describe the area and rivers where the samples were taken.
Domain 3: Accessibility/Clarity			
Metric 8:	Reporting of Results	Low	Only data is reported in Figure 2, looks to be an average concentrations with some error bars, but no standard deviation reported or summary statistics. No raw data is reported.
Metric 9:	Quality Assurance	Critically Deficient	The authors did not report recoveries or control samples. QA procedures were mentioned only in collecting triplicate samples but not discussed further
Domain 4: Variability and Uncertainty			
Metric 10:	Variability and Uncertainty	Low	The authors do not report a standard deviation.

Overall Quality Determination

Uninformative

Study Citation:		Bueno, M. J., Gomez, M. J., Herrera, S., Hernando, M. D., Agüera, A., Fernández-Alba, A. R. (2012). Occurrence and persistence of organic emerging contaminants and priority pollutants in five sewage treatment plants of Spain: two years pilot survey monitoring. Environmental Pollution 164:267-273.		
HERO ID:		5428730		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling method is well described via the information reported in the published study and supporting supplemental files, including analytical instrumentation
	Metric 2:	Analytical Methodology	High	Analytical methodology is well described via the information reported in the published study and supporting supplemental files, including analytical instrumentation
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study location is Spain
	Metric 5:	Currency	Medium	Samples collected from 2007-2008
	Metric 6:	Spatial and Temporal Variability	High	Each individual scenario has sufficient samples of HHCB as reported in the main publication and Supplemental file 1
	Metric 7:	Exposure Scenario	High	Potential environmental exposures from releases of HHCB to surface water is of relevance to the HHCB TSCA risk evaluation
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data provided
	Metric 9:	Quality Assurance	High	No significant QA/QC issues were identified which could significantly interfere with the overall reliability of the study
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	No limitations or gaps reported
Overall Quality Determination			High	

Study Citation:		Rimkus, G. G., Wolf, M. (1996). Polycyclic musk fragrances in human adipose tissue and human milk. Chemosphere 33(10):2033-2043.		
HERO ID:		5431349		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is sufficiently discussed starting in section 2
	Metric 2:	Analytical Methodology	Medium	Analytical methodology is described, including analytical instrumentation, starting on pae 2036
	Metric 3:	Biomarker Selection	High	HHCB concentration in Milk has been presented
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study location is Kiel, Schleswig-Holstein
	Metric 5:	Currency	Low	8 adipose tissue samples from females and 6 samples from males were sampled in 1993 and 1995
	Metric 6:	Spatial and Temporal Variability	Low	Small number of samples and no replicates
	Metric 7:	Exposure Scenario	Medium	HHCB in human milk samples is an important pathway of consideration however the study does not allow for the source apporpriation of HHCB specificaly from TSCA Soources
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	See data reported in Figures 1, 2 and Table 3
	Metric 9:	Quality Assurance	Low	No QA/QC mentioned
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	No limitations reported
Overall Quality Determination			Medium	

Study Citation:		Klaschka, U., von der Ohe, P. C., Bschorer, A., Krezmer, S., Sengl, M., Letzel, M. (2013). Occurrences and potential risks of 16 fragrances in five German sewage treatment plants and their receiving waters. Environmental Science and Pollution Research 20(4):2456-2471.		
HERO ID:		5431366		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology is well presented
	Metric 2:	Analytical Methodology	Low	LOD not provided
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study location is Bavaria
	Metric 5:	Currency	Medium	The study was conducted in 2009
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates were reported
	Metric 7:	Exposure Scenario	High	HHCB in surface water is of interest in its TSCA risk as presented
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Results can be found in Table 4 and 5
	Metric 9:	Quality Assurance	Low	Quality assurance not directly discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty not directly discussed
Overall Quality Determination			Medium	

Study Citation:		Gatermann, R., Biselli, S., Hühnerfuss, H., Rimkus, G. G., Franke, S., Hecker, M., Kallenborn, R., Karbe, L., König, W. A. (2002). Synthetic Musks in the Environment. Part 2: Enantioselective Transformation of the Polycyclic Musk Fragrances HHCB, AHTN, AHDI, and ATII in Freshwater Fish. Archives of Environmental Contamination and Toxicology 42(4):447-453.		
HERO ID:		5431371		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology for this study is reported though it lacks clarity and thoroughness
	Metric 2:	Analytical Methodology	Low	LOQ are provided in another publication
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study location is Germany
	Metric 5:	Currency	Low	Study was conducted in 1997
	Metric 6:	Spatial and Temporal Variability	Low	no replicates were presented; 1 to 8 samples from each species
	Metric 7:	Exposure Scenario	Low	The exposure scenario relevant to the TSCA RE for HHCB from this study is HHCB exposure from sewage plant pond
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	See Table 1 for results
	Metric 9:	Quality Assurance	Low	Quality assurance information is in another publication
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and Uncertainty not clearly discussed
Overall Quality Determination			Low	

Study Citation:		Horii, Y., Reiner, J. L., Loganathan, B. G., Senthil Kumar, K., Sajwan, K., Kannan, K. (2007). Occurrence and fate of polycyclic musks in wastewater treatment plants in Kentucky and Georgia, USA. Chemosphere 68(11):2011-2020.		
HERO ID:		5431373		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The authors said they collected grab samples of wastewater and sludge and the sampling plan is shown in Figure 1. Collection equipment and storage conditions were provided.
	Metric 2:	Analytical Methodology	High	The authors described extraction methods, analytical instrumentation. They also discussed recovery procedures and calibration procedures, and reported a LOQ.
	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 discussed the geographic location of the study.
	Metric 5:	Currency	Medium	Samples were collected during the winter, spring, summer, and fall of 2005.
	Metric 6:	Spatial and Temporal Variability	Medium	The authors collected samples from two different wastewater treatment plants, at different points in the treatment process and at three different time points over the year. The sample size total can be inferred from Tables 1 and 2. The authors did not report collecting replicate samples.
	Metric 7:	Exposure Scenario	Medium	The authors described the exposure scenario and setting.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1 displays the raw results from the sample collection and analysis and mean concentrations. Ranges are reported in the text but no standard deviation is reported.
	Metric 9:	Quality Assurance	Medium	The authors described recovery experiments with recoveries of HHCB of 87%. They also used procedural blanks but they did not mention collecting and analyzing field blanks/controls. They also mentioned performing a quality control standard analysis after every five samples to check for instrument stability.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The authors did not report a standard deviation. They did discuss different parameters such as rainfall and sampling strategy can influence the concentration of HHCB sampled at wastewater treatment plants. The authors also measured HHCB in an urban and rural wastewater plant and across different time points in the year. The authors had a limited discussion of limitations or gaps in the study results.
Overall Quality Determination			Medium	

Study Citation:		Berset, J. D., Kupper, T., Etter, R., Tarradellas, J. (2004). Considerations about the enantioselective transformation of polycyclic musks in wastewater, treated wastewater and sewage sludge and analysis of their fate in a sequencing batch reactor plant. Chemosphere 57(8):987-996.		
HERO ID:		5431376		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Part 2; field study on WWTP Chevily; Section 2.2; sludge = 10 grab samples from aeration tank; once a day; stored at 4C; confusing because two parts and only Part 1 gives concentrations in influent/effluent/sludge
	Metric 2:	Analytical Methodology	Medium	GC-MS; LOQ 20 ng/L; again confusing methodology; what was done for Part 1 vs 2
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	WWTP in Chevily
	Metric 5:	Currency	Low	2001
	Metric 6:	Spatial and Temporal Variability	Medium	during one week in April; influent n=7; effluent n=7; sludge n =7
	Metric 7:	Exposure Scenario	High	characteristics of Chevilly WWTP provided in Table 1
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 4 provides concentrations mean, median, range and SD; no raw data; no SI
	Metric 9:	Quality Assurance	Low	recovery 78%; QA/QC not discussed in detail
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	standard deviation given; compares to other studies
Overall Quality Determination			Medium	

Study Citation:		Buerge, I. J., Buser, H. R., Müller, M. D., Poiger, T. (2003). Behavior of the polycyclic musks HHCB and AHTN in lakes, two potential anthropogenic markers for domestic wastewater in surface waters. Environmental Science & Technology 37(24):5636-5644.		
HERO ID:		5431387		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology and site characteristics well described.
	Metric 2:	Analytical Methodology	High	Analytical methodology well described.
	Metric 3:	Biomarker Selection	N/A	Measured in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected in Zurich, Switzerland.
	Metric 5:	Currency	Low	Samples collected in 2001.
	Metric 6:	Spatial and Temporal Variability	Medium	No replicate samples.
	Metric 7:	Exposure Scenario	High	Setting and potential sources well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Not all raw data is reported.
	Metric 9:	Quality Assurance	High	Quality control measures were applied and no issues were identified.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some discussion of variability and uncertainty.
Overall Quality Determination			High	

Study Citation:		Gatermann, R., Biselli, S., Hühnerfuss, H., Rimkus, G. G., Hecker, M., Karbe, L. (2002). Synthetic musks in the environment. Part 1: Species-dependent bioaccumulation of polycyclic and nitro musk fragrances in freshwater fish and mussels. Archives of Environmental Contamination and Toxicology 42(4):437-446.		
HERO ID:		5431403		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods is detailed starting on page 438.
	Metric 2:	Analytical Methodology	High	Analytical methodology is detailed starting on page 438.
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The experimental site was a sewage treatment plant of the federal state of Schleswig-Holstein (Germany).
	Metric 5:	Currency	Low	Samples collected in 1997.
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates. Only two water samples, but >10 biota samples.
	Metric 7:	Exposure Scenario	Medium	Limited characterization provided.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Provided lipid and weight weight.
	Metric 9:	Quality Assurance	High	No QA/QC issues have been identified which could significantly interfere with the overall reliability of the study.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited discussion on uncertainty.
Overall Quality Determination			High	

Study Citation:		Brunsch, A. F., Langenhoff, A. A. M., Rijnaarts, H. H. M., Ahring, A., Ter Laak, T. L. (2019). In situ removal of four organic micropollutants in a small river determined by monitoring and modelling. Environmental Pollution 252(Pt A):758-766.		
HERO ID:		5431418		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Times and dates reported; multiple samples per day, some 24-h samples; storage described; concurrent data on river flow, etc.
	Metric 2:	Analytical Methodology	Medium	GC triple quad MS; LOD; method of Brunsch et al. 2018a.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Germany, River Swist
	Metric 5:	Currency	High	2015 to 2018
	Metric 6:	Spatial and Temporal Variability	High	123 samples: effluents from 4 sewage treatment plants (STPs) along river and 1 water quality station downstream of all STPs. 2015: 72 of the 123 total samples (12 x 4 STPs plus 24 from river); 35 the next year, and 16 samples in 2018.
	Metric 7:	Exposure Scenario	Medium	STP effluents and measured and modeled river concentrations; not drinking water.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	N, median and standard deviation for each STP reported by year.
	Metric 9:	Quality Assurance	Low	Not discussed per se; see Brunsch et al. 2018a.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability and uncertainty explored via modeling mass flow and comparing with measured concentrations.
Overall Quality Determination			Medium	

Study Citation:		Zeng, X., Sheng, G., Gui, H., Chen, D., Shao, W., Fu, J. (2007). Preliminary study on the occurrence and distribution of polycyclic musks in a wastewater treatment plant in Guandong, China. Chemosphere 69(8):1305-1311.		
HERO ID:		5431424		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Section 2.2; sampled every 4 h over 24 hrs from different compartments (Fig 1); put into amber bottles and preserved with 0.5% methanol at 4C; filtered and then freeze-dried
	Metric 2:	Analytical Methodology	High	Sections 2.2. and 2.3; SPE; GC–MS; LODs in Table 1;
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Guandong, China
	Metric 5:	Currency	Low	October 23, 2004
	Metric 6:	Spatial and Temporal Variability	Low	sampled only on one day; composite samples (every 4 hr) collected over 24 hr; 6 samples each of influent, primary, and effluent water
	Metric 7:	Exposure Scenario	High	WWTP receives mixed wastewater of 30% domestic sewage and 70% industrial wastewater including those from two cosmetics plants which were pre-treated in the WWTPs attached to those plants
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Table 3 provides concentrations per sample (particles and water); range, mean, and std of each type of water sample provided in Section 3
	Metric 9:	Quality Assurance	High	Section 2.4; recoveries listed in Table 2 (71% and higher); all concentrations are uncorrected for recoveries; method and spiked blanks
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	compared with previous studies; discusses variability; standard deviation reported
Overall Quality Determination			Medium	

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

Study Citation:		Gourmelon, M., Caprais, M. P., Mieszkin, S., Marti, R., Wéry, N., Jardé, E., Derrien, M., Jadas-Hécart, A., Communal, P. Y., Jaffrezic, A., Pourcher, A. M. (2010). Development of microbial and chemical MST tools to identify the origin of the faecal pollution in bathing and shellfish harvesting waters in France. Water Research 44(16):4812-4824.		
HERO ID:		5469315		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling procedures were outlined. Including sampling storage.
	Metric 2:	Analytical Methodology	Low	Analytical methodology including the instrumentation was reported. LOD were reported.
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Pays de la Loire, France.
	Metric 5:	Currency	Low	The study doesn't report a sampling date, but it was published in 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	The study analyzes 5 WWTP effluent during two sampling campaigns; measured in triplicate; then 4 wastewater and 20 surface water samples from two rivers; 3 samples from river with intense grazing.
	Metric 7:	Exposure Scenario	Medium	The study evaluates effluent from 5 WWTPs; plants and settings are not described; rivers in agricultural areas and receiving WWTP discharges.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 4 provides concentration at each WWTP during the two sampling campaigns; HHCB never detected in any rivers (data not shown). Sample replicates were collected.
	Metric 9:	Quality Assurance	Medium	The recoveries for first and second campaigns discussed in 3.1.2; extraction good for first campaign but corrected for second; QA/QC not discussed in detail.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Limitations are not reported, variability reported as RSD provided in Table 4.
Overall Quality Determination			Medium	

Study Citation:		Giorgino, M. J., Rasmussen, R. B., Pfeifle, C. M. (2007). Occurrence of organic wastewater compounds in selected surface-water supplies, Triangle Area of North Carolina, 2002-2005. Scientific Investigations Report 2007-5054 :29.		
HERO ID:		5469762		
Domain		Metric	Rating	Comments
Domain 1: Reliability		Metric 1: Sampling Methodology	High	USGS study with information on the sampling sites following established protocols and procedures.
		Metric 2: Analytical Methodology	High	Analytical methods reported in the laboratory analysis section, the reporting level is in table 3.
		Metric 3: Biomarker Selection	N/A	The parent chemical is measured in environmental media.
Domain 2: Representativeness		Metric 4: Geographic Area	High	Samples were collected in 8 sites of the Triangle Area, North Carolina, USA.
		Metric 5: Currency	Medium	Samples collected from October 2002 to July 2005.
		Metric 6: Spatial and Temporal Variability	High	A total of 42 samples were collected. Sample replicates reported in appendix 2.
		Metric 7: Exposure Scenario	High	The study evaluates the occurrence of organic wastewater compounds in surface-water supplies.
Domain 3: Accessibility/Clarity		Metric 8: Reporting of Results	High	Table 3 reports summary of statistics. Raw data reported in appendix 2.
		Metric 9: Quality Assurance	High	The study reports the use of laboratory and field QA/QC. The information is reported in the Quality Assurance section.
Domain 4: Variability and Uncertainty		Metric 10: Variability and Uncertainty	High	Variability reported in terms of the range, limitations were reported for the number of samples that were analyzed.
Overall Quality Determination			High	

Study Citation:		Fromme, H., Lahrz, T., Piloty, M., Gebhart, H., Oddoy, A., Rüden, H. (2004). Occurrence of phthalates and musk fragrances in indoor air and dust from apartments and kindergartens in Berlin (Germany). Indoor Air 14(3):188-195.		
HERO ID:		5556411		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Unclear how the sampled buildings were selected
	Metric 2:	Analytical Methodology	High	LODs provided (called "determination limits") Standard analytic methods. Blanks and recoveries measured.
	Metric 3:	Biomarker Selection	N/A	NA since testing for parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Berlin, Germany
	Metric 5:	Currency	Low	2000 to 2001
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates used. n = 59, 74, or 30
	Metric 7:	Exposure Scenario	Medium	No info on chemical use inside building.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics but no raw data
	Metric 9:	Quality Assurance	Medium	Recovery rates and blanks were used. No detailed discussion of QA/QC
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Good discussion of uncertainty and variability in the estimated phthalate intake. No discussion of limitations of the concentration data.
Overall Quality Determination			Medium	

Study Citation:		Launay, M. A., Dittmer, U., Steinmetz, H. (2016). Organic micropollutants discharged by combined sewer overflows - Characterisation of pollutant sources and stormwater-related processes. Water Research 104:82-92.		
HERO ID:		5664394		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Wastewater collected during dry weather; 24 hr composite samples collected from WWTP influent; grab samples collected from surface water along the river. Samples are homogenized samples including dissolved and particulate matter. Fig 1 depicts locations.
	Metric 2:	Analytical Methodology	High	Samples analyzed by GC-MS; detailed information about analysis and detection and quantification limits provided in SI.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected in SW Stuttgart, Germany.
	Metric 5:	Currency	Medium	Samples collected in February and July 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	Winter and summer samples included 24 hr composite samples at the WWTP influent (n=9); grab samples at 4 river location for 9 days and at 5 locations along river following 4 CSO events.
	Metric 7:	Exposure Scenario	High	Exposure source is urban catchment; WWTP and surface water; combined sewer overflow (Section 2.1)
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Fig 2b depicts concentration in WWTP influent and CSO samples; raw data provided in SI.
	Metric 9:	Quality Assurance	Medium	Blank samples were analyzed; QA/QC was discussed in SI.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Compared data to other studies; discussed variability due to rainfall events. Additional info potentially in SI.
Overall Quality Determination			High	

Study Citation:		Kronimus, A., Schwarzbauer, J., Dsikowitzky, L., Heim, S., Littke, R. (2004). Anthropogenic organic contaminants in sediments of the Lippe river, Germany. Water Research 38(16):3473-3484.		
HERO ID:		5709422		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology fully explained
	Metric 2:	Analytical Methodology	High	All methodology information is provided
	Metric 3:	Biomarker Selection	N/A	Chemical is measured in sediment
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Lippe river (Germany)
	Metric 5:	Currency	Low	Four sampling campaigns were performed in August 1999,February 2000, August 2000 and March 2001
	Metric 6:	Spatial and Temporal Variability	Medium	No replicate samples
	Metric 7:	Exposure Scenario	Medium	Sediment samples from Lippe river (Germany)
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual data points are not reported
	Metric 9:	Quality Assurance	Low	Quality assurance/control techniques are not directly discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Limitations and variability are not discussed
Overall Quality Determination			Medium	

Study Citation:		Stachel, B., Jantzen, E., Knoth, W., Kruger, F., Lepom, P., Oetken, M., Reincke, H., Sawal, G., Schwartz, R., Uhlig, S. (2005). The Elbe Flood in August 2002{\textmdash}Organic Contaminants in Sediment Samples Taken After the Flood Event. Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 40(2):265-287.		
HERO ID:		5740077		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Fine-grained, aerobic sediments collected from upper sediment layer using bottom grab or a spatula; little flow activity.
	Metric 2:	Analytical Methodology	Low	Microwave extraction with toluene, GC-MSD; not discussed further. Min <1 indicated LOQ is 1.0.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected from river Elbe in Central Europe (Czech Republic to Germany).
	Metric 5:	Currency	Low	Samples collected from September 8 - 16, 2002.
	Metric 6:	Spatial and Temporal Variability	Medium	Fig 1 depicts sampling sites on the river and mouths of tributaries. There were 37 sampling sites along the river; 11 in Czech Republic and 26 in Germany.
	Metric 7:	Exposure Scenario	High	Sediments from one of the major rivers in central Europe characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1 provides range and median; Fig 4 shows concentrations levels; further summary statistics not provided.
	Metric 9:	Quality Assurance	Low	QA/QC was not discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Briefly compares to previous studies, but characterization of variability and uncertainty was absent.
Overall Quality Determination			Medium	

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

Study Citation:		Jenkins, J. A., Goodbred, S. L., Olivier, H. M., Draugelis-Dale, R. O., Alvarez, D. A. (2009). Effects of Wastewater Discharges on Endocrine and Reproductive Function of Western Mosquitofish (Gambusia spp.) and Implications for the Threatened Santa Ana Sucker (Catostomus santaanae). :46.		
HERO ID:		5813584		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Details about passive sampling were described. Sample storage and transport were not described in detail. The number of samples is unclear.
	Metric 2:	Analytical Methodology	Low	The analytical methods were discussed, mentioning recoveries but they were not reported. The LOQ was not reported.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in United States.
	Metric 5:	Currency	Medium	The samples were collected in 2005.
	Metric 6:	Spatial and Temporal Variability	Low	The number of samples is unclear.
	Metric 7:	Exposure Scenario	Medium	The data likely represent relevant exposure scenarios related to HHCB present in Santa Ana River.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	The units are reported as ug/sampler so might not be able to normalize the data.
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was not characterized. Uncertainties were briefly discussed.
Overall Quality Determination			Low	

Study Citation:		Hart, R. J., Taylor, H. E., Antweiler, R. C., Fisk, G. G., Anderson, G. M., Roth, D. A., Flynn, M. E., Peart, D. B., Truini, M., Barber, L. B. (2005). Physical and chemical characteristics of Knowles, Forgotten, and Moqui Canyons, and effects of recreational use on water quality, Lake Powell, Arizona and Utah. U.S. Geological Survey :116.		
HERO ID:		5821282		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	USGS report; water samples collected at selected locations in each side canyon using a specially designed depth-sampling device: a laboratory precleaned 2-L polytetrafluoroethane (PTFE) bottle housed in an aluminum canister (p.8 sample collection of water); all samples chilled and placed in the dark; samples filtered (p. 8)
	Metric 2:	Analytical Methodology	Medium	Continuous liquid-liquid extraction with methylene chloride; GC/MS; p. 11; calibration curves for instrumental determinations were established; based on Table 12 seems LDL is 0.5 ug/L.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected in Knowles, Forgotten, and Moqui Canyons of Lake Powell in Arizona and Utah.
	Metric 5:	Currency	Low	Samples collected in summers of 2001 and 2002.
	Metric 6:	Spatial and Temporal Variability	High	More than 10 samples over 4 sampling trips (May 15-17, 2001; September 5-7, 2001; May 20-22, 2002; September 9-12, 2002); refer to Fig 1 and Table 12.
	Metric 7:	Exposure Scenario	High	2 and 3 million people visit Glen Canyon National Recreation Area each year; high usage; water in these side canyons could receive chemical and biological contamination directly or indirectly fromhuman activities in the watershed.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data reported in Table 12 (p.1 and 2); no other summary statistics provided.
	Metric 9:	Quality Assurance	Medium	Laboratory reagent blanks and field process blanks were analyzed; Knowles Canyon treated as a control; recoveries not provided (p.11).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Limited reference to level of contaminants in other studies; nothing chemical specific.
Overall Quality Determination			Medium	

Study Citation:		HEL, (2018). Occurrence, distribution and ecological risks of organophosphate esters and synthetic musks in sediments from the Hun River. Ecotoxi- cology and Environmental Safety 160:178-183.		
HERO ID:		5918412		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling procedures were outlined, but sample storage duration was not reported.
	Metric 2:	Analytical Methodology	Low	The analytical methods were reported, the LOD was mentioned but not reported.
	Metric 3:	Biomarker Selection	N/A	Parent chemical measured in sediment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Hun River, China.
	Metric 5:	Currency	Medium	Samples were collected in July 2010
	Metric 6:	Spatial and Temporal Variability	Medium	40 surface sediment (0–5 cm) samples were collected, but no replicate samples.
	Metric 7:	Exposure Scenario	High	Samples taken from Hun River
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No individual data points reported. Table 1 reports concentration range.
	Metric 9:	Quality Assurance	High	Section 2.4. reports quality assurance and quality control.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited discussion of uncertainties, variability reported in terms of range.
Overall Quality Determination			Medium	

Study Citation:		Duedahl-Olesen, L., Cederberg, T., Pedersen, K. H., Hojgard, A. (2005). Synthetic musk fragrances in trout from danish fish farms and human milk. Chemosphere 61(3):422.		
HERO ID:		5918994		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Section 2 sufficiently presents smapling methodology applied
	Metric 2:	Analytical Methodology	High	LOD provided
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Denmark
	Metric 5:	Currency	Low	Data from 1999 and 2003/2004
	Metric 6:	Spatial and Temporal Variability	Medium	>10 samples; no replicates
	Metric 7:	Exposure Scenario	High	The exposure scenario discussed in the monitored study sufficiently represents the exposure scenario of interest for the chemical
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	no raw data
	Metric 9:	Quality Assurance	High	Recovery samples presented and discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	no limitations reported
Overall Quality Determination			High	

Study Citation:		Kupper, T., Berset, J. D., Etter-Holzer, R., Furrer, R., Tarradellas, J. (2004). Concentrations and specific loads of polycyclic musks in sewage sludge originating from a monitoring network in switzerland. Chemosphere 54(8):1111.		
HERO ID:		5919095		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology fully explained
	Metric 2:	Analytical Methodology	High	Analytical methodology fully explained, 2.3.5. Recovery experiments and detection and quantificationlimits (LOD/LOQ)
	Metric 3:	Biomarker Selection	N/A	Chemical measured in sludge
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study occurred in Switzerland
	Metric 5:	Currency	Low	Sampling was conducted in February and March2001 (sampling period 1; Table 3) and was repeated onfive sites in July 2001 (sampling period 2). Site B13 wassampled in July only.
	Metric 6:	Spatial and Temporal Variability	Medium	< 10 samples; 8–15 aliquots were collected in a container.
	Metric 7:	Exposure Scenario	Medium	No use of exposure controls
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual data points are not reported.
	Metric 9:	Quality Assurance	Low	Quality assurance techniques not directly discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited characterization of variability; Mentioned that the sample sizes are too small to perform reasonable tests to conform or refute normality.
Overall Quality Determination			Medium	

Study Citation:		O'Toolet, S., Metcalfe, C. (2006). Synthetic musks in fish from urbanized areas of the Lower Great Lakes, Canada. Journal of Great Lakes Research 32(2):361-369.		
HERO ID:		5919136		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	sample storage not described
	Metric 2:	Analytical Methodology	High	LOQ in table 2
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	lower Great Lakes: Hamilton Harbour in western Lake Ontario, and the Detroit River and nearby western Lake Erie.
	Metric 5:	Currency	Low	2002
	Metric 6:	Spatial and Temporal Variability	Low	1-3 fish species per site
	Metric 7:	Exposure Scenario	Medium	Comment Required
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 3 summary data
	Metric 9:	Quality Assurance	Medium	recoveries and blanks discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Discussed on page 367: "The fish chosen for analysis are not philopatric species, and so high variability in musk concentrations may have been due to the movements of individual fish through contaminated and uncontaminated areas. In addition, the wet weights of the fish varied, which may indicate that fish of different ages and body condition were analyzed...."
Overall Quality Determination			Medium	

Study Citation:		Nilsen, E. B., Alvarez, D. (2011). Water-quality monitoring for a pilot piling removal field evaluation, Coal Creek Slough, Washington, 2008-09. :26.		
HERO ID:		5919173		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	sample canister and replicate sample canister each containing 3 SPMDs and 2 POCIS were deployed at CCS1 for 1 month; at control site, single canister with 3 SPMD and 2 POCIS; second set deployed at both sites 1 year after, during same flow season (Table 1)
	Metric 2:	Analytical Methodology	Low	SPMDs and POCIS created at Columbia Environmental Research Center (CERC), deployed, retrieved, and returned to CERC for processing and analysis
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Coal Creek Slough, Washington (Fig 1)
	Metric 5:	Currency	Medium	2008 (before piling removal) and 2009 (after piling removal)
	Metric 6:	Spatial and Temporal Variability	High	sampled for month before and after; deployed at each site for about 1 month; replicate samples
	Metric 7:	Exposure Scenario	Medium	water and sediment pilot monitoring before and after removal of a piling field; concentrations at piling removal site and at a comparison site
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	concentrations in SPMDs were 190, 66, and <10 ng/SPMD for site CCS1, site CCS1 replicate, and site CCS2 respectively (p. 18); no further data reported; no other data for this chemical provided in SI
	Metric 9:	Quality Assurance	High	a comparison site (CCS2); passive samplers included field blanks, laboratory blanks, matrix and procedural recovery spikes, and continuous instrument calibration checks; recoveries were within acceptable ranges
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Because equipment at the 2008 site CCS2 was lost due to vandalism, only the 2009 dataset was available to compare conditions between sites. With so few samples, statistical differences were not determined

Overall Quality Determination**Medium**

Study Citation:		Schwarzbauer, J., Littke, H. (2004). Quantitative evaluation of elbe river-derived organic marker compounds in sediment samples from the german bight. Journal of Soils and Sediments 4(3):177-183.		
HERO ID:		5919271		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling locations and details provided in Table 1 and Fig 1a; van Veen grab; stored in glass flasks at 4C in dark; filtered
	Metric 2:	Analytical Methodology	High	extracted with mixture of acetone and n-hexane using high-speed dispersion tool; GC/MS; 4-pt calibration; LOQ was 0.01 ug/kg; recoveries determined in duplicate
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	German Bight (southeastern part of North Sea)
	Metric 5:	Currency	Low	1998
	Metric 6:	Spatial and Temporal Variability	Medium	7 sediment samples; examines spatial distribution within the German Bight (Fig 1); specific dates within 1998 not provided
	Metric 7:	Exposure Scenario	High	various industrial and municipal sources of pollution to German Bight
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	concentration of each sample provided in Table 3; summary statistics not provided
	Metric 9:	Quality Assurance	Medium	procedural blanks processed; no preselected compounds detected in the blanks; recovery 43%
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	results limited due to restricted number of samples; no further discussion or details
Overall Quality Determination			Medium	

Study Citation:		Verbruggen, E. M. J., Van Loon, W. M. G.,M, Tonkes, M., Van Duijn, P., Seinen, W., Hermens, J. L. M. (1999). Biomimetic extraction as a tool to identify chemicals with high bioconcentration potential: An illustration by two fragrances in sewage treatment plant effluents and surface waters. Environmental Science & Technology 33(5):801-806.		
HERO ID:		5919365		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	effluent from Institute of Inland Water Management and Waste Water Treatment and kept anonymous; surface water collected into glass sample bottle and stored at 4C in dark
	Metric 2:	Analytical Methodology	High	biomimetic extractions; GC-MS; LOD 0.1 ng/L; instrument calibration discussed
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The Netherlands
	Metric 5:	Currency	Low	1995/1996
	Metric 6:	Spatial and Temporal Variability	Medium	effluents (n=10) from winter 1995/1996; surface samples (n=12) in spring 1995
	Metric 7:	Exposure Scenario	High	effluents from chemical industries, paper industries, and sewage treatment plants; surface water from most water types in Netherlands
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Table 1 provides concentrations of HHCB per site; summary statistics provided in discussion starting on p. 805
	Metric 9:	Quality Assurance	Low	no specifically discussed but implied
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	discussion of variability and uncertainty; no standard deviations
Overall Quality Determination			Medium	

Study Citation:		Lorenzo-Toja, Y., Alfonsín, C., Amores, M. J., Aldea, X., Marin, D., Moreira, M. T., Feijoo, G. (2016). Beyond the conventional life cycle inventory in wastewater treatment plants. Science of the Total Environment 553(Elsevier):71-82.		
HERO ID:		6090337		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methods are not fully explained
	Metric 2:	Analytical Methodology	Medium	No recovery samples
	Metric 3:	Biomarker Selection	N/A	Chemical is measured in wastewater
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Galicia and Catalonia Spain
	Metric 5:	Currency	Low	Sampling date not provided, but publication date is available.
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size is not reported
	Metric 7:	Exposure Scenario	Medium	No use of exposure controls
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual data points are not reported
	Metric 9:	Quality Assurance	Low	Quality assurance/control techniques are not directly discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No discussion of limitations
Overall Quality Determination			Uninformative	

Study Citation:		Mercier, F., Gilles, E., Soulard, P., Mandin, C., Dassonville, C., Le Bot, B. (2020). On-line coupling of thermal extraction with gas chromatography / tandem mass spectrometry for the analysis of semivolatile organic compounds in a few milligrams of indoor dust. Journal of Chromatography A 1615:460768.		
HERO ID:		6393969		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Random subsample of 5 dust samples collected in French schools. The locations (within each school) of the dust samples are not reported.
	Metric 2:	Analytical Methodology	High	LOD and LOQ reported. Results show that the new method performs as well as the conventional method for standard reference materials.
	Metric 3:	Biomarker Selection	N/A	N/A since testing for parent chemical in an environmental medium.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	France
	Metric 5:	Currency	Medium	2013 to 2017
	Metric 6:	Spatial and Temporal Variability	Medium	5 samples. Replicate samples were used to compare the two methods. Replicates were also used for the 5 school dust samples.
	Metric 7:	Exposure Scenario	High	School data is from a large school survey.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	SI lists summary statistics for the 5 replicates of all 5 samples.
	Metric 9:	Quality Assurance	High	Thorough QA/QC discussion.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Good discussion of uncertainties/variability in main paper.
Overall Quality Determination			High	

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

Study Citation:		Shin, H., Moschet, C., Young, T. M., Bennett, D. H. (2019). Measured concentrations of consumer product chemicals in California house dust: Implications for sources, exposure, and toxicity potential. Indoor Air 30(1):60-75.		
HERO ID:		6968217		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Method for recruiting the 38 households not explained.
	Metric 2:	Analytical Methodology	High	Standard LC and GC protocols were described and LODs were reported.
	Metric 3:	Biomarker Selection	N/A	Testing for the parent chemical in an environmental media
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Northern California.
	Metric 5:	Currency	High	Samples were collected in 2015-2016.
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates were reported among 38 samples.
	Metric 7:	Exposure Scenario	Medium	Limited information on chemical use.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported. Summary statistics were reported.
	Metric 9:	Quality Assurance	Low	No discussion of QA/QC although standard protocols were used. No discussion of recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some uncertainties and limitations are discussed in the section entitled "Overview and scope of this study".
Overall Quality Determination			Medium	

Study Citation:		COWI AS, (2018). 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:		Dodson, R. E., Nishioka, M., Standley, L. J., Perovich, L. J., Brody, J. G., Rudel, R. A. (2012). Endocrine disruptors and asthma-associated chemicals in consumer products. Environmental Health Perspectives 120(7):935-943.		
HERO ID:		1325358		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	Low	Sampling methodology explained but not from an authoritative or referenced source. Choose to use composite samples (mixed different sources to make one average product).
	Metric 2:	Analytical Methodology	High	Analytical methods described and appear scientifically sound. LOD and additional information in the supplemental file.
	Metric 3:	Biomarker Selection	N/A	Tested consumer products.
Domain 2: Representative				
	Metric 4:	Testing Scenario	High	Data likely to represent relevant exposure from alternative products.
	Metric 5:	Sample Size and Variability	Medium	Number of products used to make "composite" product ranged from 1-8; 27 different products tested; included duplicate samples.
	Metric 6:	Temporality	Medium	Tested products from between 5-10 years ago.
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	Raw data not reported - exact concentrations remain unknown.
	Metric 8:	Quality Assurance	High	QA/QC described (details in supplemental file).
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	High	Discussion included on variability and uncertainty.
Overall Quality Determination			High	

Study Citation:		Correia, P., Cruz, A., Santos, L., Alves, A. (2013). Human dermal exposure to galaxolide from personal care products. International Journal of Cosmetic Science 35(3):299-309.		
HERO ID:		1863036		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	Medium	The sample sources are not described; this may have affected the results. The authors claim that there are some differences between HHCB concentrations in products from Asia, U.S., and Europe and refer to Table 1, but the table does not indicate the source distinctions by product. The authors are associated with institutions in Portugal, and mention the importance of evaluating the human exposure risk from HHCB in Portugal, so I could assume that the authors obtained the products from Portuguese markets.Sample storage and handling is not described (other than preparation for analysis); these are not likely to affect the results, as these are common commercial products that do not require refrigeration (but this could have been stated).
	Metric 2:	Analytical Methodology	High	The authors test a method (adapted) previously used for measuring pesticides in fruits and vegetables. They provide details on the sample preparation, extraction process, analytical instrumentation, LOD and LOQ (in text), and recoveries.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative				
	Metric 4:	Testing Scenario	High	The authors clarify the types of products used (in general categories) and describe variations on the sample treatment and additives employed. For exposure, the authors include the amount of product used and the dermal areas that come in contact with the additives employed. For exposure, the authors include the amount product for each type, as it applied to the estimates of exposure (human).
	Metric 5:	Sample Size and Variability	Low	The sample size is not given for Table 3, the primary results, although the authors describe tests that involved repeated injections (6) of each sample at three different concentrations. The authors state the variation found in the results (presumably mean and standard deviation). I could assume that the results in Table 3 were based on the six injections, but, in any case, the applicable sample size should have been stated by the authors.
	Metric 6:	Temporality	Medium	The paper was published in 2013; the samples are assumed to be collected in 2012, which is within 5-15 years of the current year. It can also be inferred that the samples were collected after 2007 given the researchers' use of "MICROSOFT EXCEL 2007 ... for all statistical work."
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Low	The values shown in Table 3 (primary data) do not have a sample size and the calculation that derived the main number is not given (I assume it to be a mean, with the standard deviation, but this is not stated). I would score this low for missing information.The values shown in Table 4, which should be the primary data applied to a model for dermal exposure, do not match the values in Table 3. I didn't see a description of the approach to select or modify the primary results as part of the process to estimate the risk exposures. Table 4 only shows one value per product type, and they are not obvious derivations of the range of values presented in Table 3 (e.g., soap bar is the same as the presumed mean, yet shampoo is significantly (20%) different). I would score this low, or even unacceptable, because the values do not match, and I do not see that the authors describe the differences.
	Metric 8:	Quality Assurance	High	The authors include laboratory blanks and recoveries and apply recoveries to the values reported in Table 3 (primary data).
Domain 4: Variability and Uncertainty				
Continued on next page ...				

...continued from previous page

Study Citation: Correia, P., Cruz, A., Santos, L., Alves, A. (2013). Human dermal exposure to galaxolide from personal care products. International Journal of Cosmetic Science 35(3):299-309.
HERO ID: 1863036

Domain	Metric	Rating	Comments
	Metric 9: Variability and Uncertainty	Medium	The authors describe the high variability seemingly inherent in laboratory analysis of HHCB in personal care products; they also include (presumably) standard deviation in the primary results for Table 3. Thus, the rank for variability is high.The authors also claim that there are some differences between HHCB concentrations from products in different parts of the world. There is very little evidence to support the comparability of the values that the authors derive for Tables 3 or 4. The rank for uncertainty is low (identified but not explained in terms of the useable quality of these results that are derived from sources from unidentified locations and a new analytical technique for the chemicals and the sample media).

Overall Quality Determination **Medium**

Study Citation:		Roosens, L., Covaci, A., Neels, H. (2007). Concentrations of synthetic musk compounds in personal care and sanitation products and human exposure profiles through dermal application. Chemosphere 69(10):1540-1547.		
HERO ID:		1968024		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Con- ditions	High	Adequate discussion of importance of choosing the consumer product types tested: personal care and sanitation
	Metric 2:	Analytical Methodology	High	Adequate description of sample handling and analysis method: performed on an Agilent 6890 GC/MSD in EI mode;
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative				
	Metric 4:	Testing Scenario	High	Accounted for high/medium/low exposure scenarios in testing
	Metric 5:	Sample Size and Variability	High	Personal care products and sanitation products (n = 82) were obtained through cooperation of several volun- teers.The samples were divided into six categories: sanitation products (n = 14), perfumes (n = 19), deodorants (n = 4), hair care products (n = 12), shower and bath products (n = 18) and body lotions (n = 15).
	Metric 6:	Temporality	Medium	2007; 5-15 years old
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	LOQ calculated; Table 3 Median, mean and range concentration in products; no raw data; Table 4 Exposure profiles (LE: low exposure, ME: medium exposure, HE: high exposure); compared results to prior studies with good agreement; used results of another human simulated exposure study to estimate human dermal uptake,
	Metric 8:	Quality Assurance	High	Thorough discussion of QA/QC procedures: deviation from calibration standards was considered; calibration curve was constructed; Six spiked samples were subsequently compared; three procedural blanks were run with batch of 15 samples; no significant difference was found between analyses performed on different days
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	High	Adequate discussion of several variables involved: variety of products, the broad concentration range, the amount and the frequency in which products are used and the varying surface area over which they are applied; Utilized dietary (fish) intake exposure data with dermal to indicate other exposures occur
Overall Quality Determination			High	

Study Citation:		Zhang, X., Yao, Y.,u, Zeng, X., Qian, G., Guo, Y., Wu, M., Sheng, G., Fu, J. (2008). Synthetic musks in the aquatic environment and personal care products in Shanghai, China. Chemosphere 72(10):1553-1558.		
HERO ID:		5427894		
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling Methodology and Conditions	Medium	Brief discussion of sampling: According to the market share reported in detergent and cosmetics during 2003–2005, 31 frequently used household commodities were chosen including personal care and sanitary products. All were purchased from supermarkets in Shanghai. The liquid samples include perfume, bath gel, liquid hand soap, liquid facial soap, shampoo, fabric softener and detergent; while the solid samples contain laundry detergent, toothpaste and facial/body cream.
	Metric 2:	Analytical Methodology	High	Adequately discussed GC/MS analytical method used
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative	Metric 4:	Testing Scenario	Medium	Relevant household commodities tested; little information on how they are grouped or used
	Metric 5:	Sample Size and Variability	Medium	31 total household commodities tested across 7 groups, but individual group "n" not indicated; little description of components of each commodity group
	Metric 6:	Temporality	Medium	2008, 5-15 yrs old
Domain 3: Accessibility/Clarity	Metric 7:	Reporting of Results	Medium	no raw data; LOQ established and reported; mean values of only 3 commodity groups reported, no SD; range across all commodities given: nd to highest mean detected; Key for Figure 3 is not discernable. Makes comparison to values found in studies from other countries.
	Metric 8:	Quality Assurance	Medium	Less than adequate discussion regarding QA/QC specifically among the commodity tests. Generally, for each batch of 15 samples, a procedural blank, a spiked blank, a matrix spiking sample, and a matrix spiking duplicate sample were processed. Reported concentrations were not surrogate recovery corrected. Only low concentration of HHCB was detected in a procedural blank, hence blank values were not subtracted from the sample measurements.
Domain 4: Variability and Uncertainty	Metric 9:	Variability and Uncertainty	Low	Large variability among tested household commodities, less within group variability, which is not adequately discussed. No discussion of uncertainties within values found.
Overall Quality Determination			Medium	

Study Citation:		Tseng, W. J., Tsai, S. W. (2019). Assessment of dermal exposures for synthetic musks from personal care products in Taiwan. Science of the Total Environment 669:160-167.		
HERO ID:		5427988		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	High	Good discussion of what was sampled among the personal care products; all purchased from supermarkets, hypermarkets,and department stores in Taiwan;
	Metric 2:	Analytical Methodology	High	Detailed discussion of analytical methodology: triple quadrupole GC–MS/MS with MRM transition pairs; the samples of PCPs were extracted by HS-SPME.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative				
	Metric 4:	Testing Scenario	High	Highly relevant testing conditions for purposes of exposure
	Metric 5:	Sample Size and Variability	High	Large sample size with greater than 10 samples per scenario: 109 PCPs samples were collected from supermarkets, hypermarkets, and department stores in Taiwan. The samples were divided into six categories, which were perfume (N = 16), body lotion (N= 37), hair care product (N = 19), shower bath product (N= 14), facial essence (N= 11) and household product (N= 12).
	Metric 6:	Temporality	High	within past 5 years
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	High	no raw data; MDL calculated and reported; group n reported; mean/median/SD/min/max reported; comparison of values across multiple similar studies
	Metric 8:	Quality Assurance	High	Highly satisfactory QA/QC procedures; Calibration range, method detection limit, RSD, spike recovery, and MRM transitions; fume hood; procedure blanks;
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	High	Good discussion of variability across different studies to describe uncertainties in various analytical methods; HS-SPME: Conducted under different periods of time, including 20, 30, 40, and 50 min, for headspace extraction were performed to get the adsorption-time profile. Effects of different temperature, including 30, 50, 70, and 90 °C, on extraction were also evaluated.
Overall Quality Determination			High	

Study Citation:		Reiner, J. L., Kannan, K. (2006). A survey of polycyclic musks in selected household commodities from the United States. Chemosphere 62(6):867-873.		
HERO ID:		5428043		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	High	Adequate discussion of purpose/selection of household commodities tested, all purchased in Albany NY
	Metric 2:	Analytical Methodology	High	Adequate discussion of approved analytical methodology for this testing; (GC-MSD; Agilent Technologies 6890 GC and 5973 Series MSD).
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative				
	Metric 4:	Testing Scenario	High	Very likely exposure scenarios to household commodities presented
	Metric 5:	Sample Size and Variability	High	Good sample size and variety: 60 household commodities grouped into six categories where most contain n => 7, one containing n = 4
	Metric 6:	Temporality	Low	2005; > 15 yrs old
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	High	raw data; LOQ calculated and reported; average +- SD calculated for each group; also recorded % of samples that contained HHCB,
	Metric 8:	Quality Assurance	High	Adequate discussion of QA/QC procedures; fume hood; procedural blanks - contained trace levels of HHCB and the limit of detection (LOD) was set to be twice the concentration that was found in blanks; external calibration standards used; concentrations in samples were corrected for the recoveries of the surrogate standard.
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Medium	Adequate discussion of variability of concentrations across commodity groups and within group variability; comparison with other studies;
Overall Quality Determination			High	

Study Citation:		Chen, F., Ying, G., Ma, Y.,iB, Chen, Z., Lai, H., Peng, F. J. (2014). Field dissipation and risk assessment of typical personal care products TCC, TCS, AHTN and HHCB in biosolid-amended soils. Science of the Total Environment 470:1078-1086.		
HERO ID:		5428493		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	High	Adequate discussion of sampling/sites, Table 2; biosolid used for the field experiments was obtained from Beijing centralized sludge treatment plant, which treats 70% of sludge from domestic wastewater treatment plants in Beijing, sample biosolid tested for HHCB prior to field application; three field treatments (control, T1, T2) were conducted at three sites in China, each treatment had four replicate plots
	Metric 2:	Analytical Methodology	High	Adequate discussion of analytical methodology: GC/MS, selected ion monitoring mode following electron-impact ionization; flow chart in SI file
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative				
	Metric 4:	Testing Scenario	Medium	Biosolid application to fields is becoming a more common practice
	Metric 5:	Sample Size and Variability	Medium	Three field treatments (control, T1, T2) were conducted at three sites in China, each treatment with four replicate plots; n = 12 per treatment; T1: one application; T2: multiple applications of biosolids; n = 4 per treatment/per location
	Metric 6:	Temporality	Medium	2007 first application - 2010 analysis; 5-15 years old
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	No raw data; Mean and SD calculated in Table S3; LOQ, LOD and % Recovery reported in Table S2; Dissipation curves over time in Table S4;
	Metric 8:	Quality Assurance	High	Adequate discussion of QA/QC; reagent blank, method blank and spiked matrix were analyzed; No HHCB detected in the blank soils; satisfactory performance for recovery, LOD, and LOQ were obtained (SI file)
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Medium	Adequate discussion of variability of environmental conditions across sites, site soil/temp/type; dissipation in the biosolid-amended soils could be influenced by many factors discussed
Overall Quality Determination			High	

Study Citation:		Lu, Y., Yuan, T., Wenhua, W., Kannan, K. (2011). Concentrations and assessment of exposure to siloxanes and synthetic musks in personal care products from China. Environmental Pollution 159(12):3522-3528.		
HERO ID:		6301725		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	High	Adequate discussion of the selection of personal care products tested from China; 158 personal care products purchased from retail stores in Shanghai, China sorted into six categories
	Metric 2:	Analytical Methodology	High	Adequate discussion of approved analytical methodology; by GC/MS (Agilent 6890GC and 5972MS; electron-impact ionization mass spectrometer (EI/MS); quantified based on the external calibration standards
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative				
	Metric 4:	Testing Scenario	High	Relevant exposure scenarios to variety of personal care products
	Metric 5:	Sample Size and Variability	High	Large sample size of 158 personal care products tested; all were purchased from retail stores in Shanghai, China, in 2009 and all of the samples were produced in China. The samples were grouped into six categories where n >= 10. Details of the products analyzed are given in Supporting Information but evaluation possible without SI file.
	Metric 6:	Temporality	Medium	samples purchased in 2009; 5 - 15 years old
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	Adequate discussion of results; no raw data; LOQ calculated and reported; Concentrations reported as median, mean, and range; and frequency of occurrence (%)
	Metric 8:	Quality Assurance	Medium	Adequate discussion of QA/QC protocols; Avoidance of detergents and cosmetics in the lab; Procedural blanks were analyzed with every 12 samples. Trace levels of HHCB were detected in procedural blanks; the limit of quantification (LOQ) for these compounds was set to be 3 times the mean concentration found in blank samples; blank values were subtracted; Recovery tests were performed by spiking of a standard mixture; reported data were not corrected for the recoveries of surrogate standards.
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Medium	Adequate discussion of variability and some comparison across other studies; sample-to-sample variation existed in the concentrations, HHCB was the predominant compound found in each category of the products analyzed;
Overall Quality Determination			High	

Study Citation:		U.S. EPA, U.,S.G.S. and National Water Quality Monitoring Council (2022). (1,3,4,6,7,8-Hexahydro-4,6,6,7,8,8-hexamethylcyclopenta [g]-2-benzopyran (HHCB) (CAS RN: 1222-05-5): WQP Output (NWIS, STEWARDS {\&} STORET), Site data {\&} sample results (physical/chemical metadata).		
HERO ID:		10709400		
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 information of each code can be found at https://waterdata.usgs.gov/nwis/si
	Metric 4:	Temporal	High	Data was collected from 1991 to 2022. The date is reported in column G.
	Metric 5:	Exposure Scenario	Medium	Media are reported in column E and F; location and time are also reported. There is no information provided on sources of chemicals.
Domain 3: Accessibility/Clarity	Metric 6:	Availability of Database and Supporting Documents	High	The database is widely accepted, and a user guide is available which describes all of the data fields.
	Metric 7:	Reporting Results	Medium	The database does not report summary of statistics, only point values. While the data are well organized, since the data originates from numerous different entities (states) and monitoring programs, some data may be difficult to interpret due to the lack of populated data fields or discrepancies between columns.
Domain 4: Variability and Uncertainty	Metric 8:	Variability and Uncertainty	Medium	Uncertainty is characterized by the inclusion of data qualifier column AR; however, it was not expected for all rows to have a data qualifier code. Column AS reports the results status identifier that indicates the acceptability of the result with respect to QA/QC criteria.
Overall Quality Determination			High	

Study Citation: Langdon, K. A., Warne, M. S., Kookana, R. S. (2010). Aquatic hazard assessment for pharmaceuticals, personal care products, and endocrine-disrupting compounds from biosolids-amended land. Integrated Environmental Assessment and Management 6(4):663-676.				
HERO ID: 1402874				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	Medium	The study did not provide information on systematic review process to find measured concentrations. Equations provided for predicted concentrations.
Domain 2: Representative	Metric 2:	Exposure Scenario	Medium	Worst case scenario was assessed, but not much characterizing information about this scenario.
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	Low	References provided, but uncertain of exact references for the measured concentrations, therefor assigning low score.
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	Medium	Some discussions on uncertainty - overestimations, degradation, etc.
Overall Quality Determination			Medium	

Study Citation:		ECB, (2008). European Union risk assessment report: 1,3,4,6,7,8-hexahydro-4,6,6,7,8,8-hexamethylcyclopenta- $\{\gamma\}$ -2-benzopyran (HHCB).		
HERO ID:		5155574		
Domain		Metric	Rating	Comments
Domain 1: Reliability		Metric 1: Methodology	High	Used EU methodologies.
Domain 2: Representative		Metric 2: Exposure Scenario	Medium	Relevant use patterns, although older data.
Domain 3: Accessibility/Clarity		Metric 3: Documentation of References	High	Reported data including the documentation of references is clear.
Domain 4: Variability and Uncertainty		Metric 4: Variability and Uncertainty	Medium	While there was some consideration of uncertainties and variability, such discussion lacked sufficient detail.
Overall Quality Determination			High	

Study Citation:		Balk, F., Ford, R. A. (1999). Environmental risk assessment for the polycyclic musks AHTN and HHCB in the EU. I. Fate and exposure assessment. Toxicology Letters 111(1-2):57-79.		
HERO ID:		5349126		
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	Medium	The study uses both measured concentrations and predicted concentrations to estimate concentrations for the risk estimate. EUSES was used for the PECs, a well known screening model.
Domain 2: Representative	Metric 2:	Exposure Scenario	Medium	Scenarios are of interest, however, data is older (1990's).
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	Low	The paper is well documented, however, many of the references are in a foreign language (Dutch, German).
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	Medium	Used data from multiple countries. Three STPs were specifically sampled. Discussion of overestimation of exposure based on per capita use info (as compared to actual measurements).
Overall Quality Determination			Medium	

Study Citation:		Tamura, I., Kimura, K., Kameda, Y., Nakada, N., Yamamoto, H. (2013). Ecological risk assessment of urban creek sediments contaminated by untreated domestic wastewater: potential contribution of antimicrobials and a musk fragrance. Environmental Technology 34(12):1567-1575.		
HERO ID:		5427931		
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	Used standard HQ methodology. No info provided on systematic review methodology.
Domain 2: Representative	Metric 2:	Exposure Scenario	Medium	Eco risk assessment using US data as well as other countries. However, little characterizing info is provided on the secondary monitoring data.
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	High	Comment Required
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	Medium	Examined variability by determining HQ for numerous studies.
Overall Quality Determination			High	

Study Citation:		Fan, B.,o, Wang, X., Li, J.,i, Gao, X., Li, W., Huang, Y.,un, Liu, Z. (2019). Deriving aquatic life criteria for galaxolide (HHCB) and ecological risk assessment. Science of the Total Environment 681:488-496.		
HERO ID:		5428397		
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	Medium	Used standard methods to evaluate risk, however no discussion of systematic review process.
Domain 2: Representative	Metric 2:	Exposure Scenario	Medium	Calculated HQ for US data for eco assessment, however, little characterization of the monitoring data.
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	High	Data reported in the main report and supplemental file are well documented and clear.
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	Medium	Compared results across different studies to demonstrate variability. Little discussion of uncertainties.
Overall Quality Determination			Medium	

Study Citation:		Schlumpf, M., Kypke, K., Wittassek, M., Angerer, J., Mascher, H., Mascher, D., Vökt, C., Birchler, M., Lichtensteiger, W. (2010). Exposure patterns of UV filters, fragrances, parabens, phthalates, organochlor pesticides, PBDEs, and PCBs in human milk: correlation of UV filters with use of cosmetics. Chemosphere 81(10):1171-1183.		
HERO ID:		1249442		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	Medium	Equations for intake of chemicals analyzed in milk fat and intake of parabens and phthalates for dose provided in text. No citation provided for parabens and phthalates but appears standard and scientifically sound.
	Metric 2:	Model Evaluation	Medium	No indication of evaluation of for parabens and phthalates equation, seems to be conducted by author.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Exposure is specific to infants ingesting breast milk; the paper proposes a correlation of breast milk concentrations with use of personal care products and certain diets, but that does not necessarily modify the infant intake scenario.
	Metric 4:	Model and Model Documentation Availability	Low	Milk fat equation reference provided, but not for parabens and phthalates equation.
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	Medium	Daily intake of chemicals by milk are reported in table 7. Some inputs have citations. However, methods for calculations are unclear.
	Metric 6:	Variability and Uncertainty	Low	Minimal discussion of variability or uncertainty. Some discussion on the lack of data and studies related to temporal variability of human exposure.
Overall Quality Determination		Medium		

Study Citation:		Weschler, C. J., Nazaroff, W. W. (2012). SVOC exposure indoors: Fresh look at dermal pathways. Indoor Air 22(5):356-377.		
HERO ID:		1315313		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	All equations are provided in detail with cited references, assuming some validity based on previous peer review
	Metric 2:	Model Evaluation	Medium	Model equations discussed across studies and some estimates compared to other studies
Domain 2: Representative	Metric 3:	Exposure Scenario	High	Dermal exposure to chemicals is a relevant scenario and can be applied to a variety of products; Data used in the models is from USEPA study of Children's Total Exposure to Persistent Pesticides and Other Persistent Organic Pollutants (CTEPP)
Domain 3: Accessibility/Clarity	Metric 4:	Model and Model Documentation Availability	High	Model can be followed through in order of presentation with use of references, no user guide needed
	Metric 5:	Model Inputs and Defaults	High	All inputs are provided with citations for values or equations
Domain 4: Variability and Uncertainty	Metric 6:	Variability and Uncertainty	High	Discussion of chemical specific properties and other pathways not covered by the presented models as limitations; uncertainties discussed around assumption of equilibrium
Overall Quality Determination		High		

Study Citation:		Lu, Y.,an, Yuan, T.,ao, Yun, S., Wang, W., Kannan, K. (2011). Occurrence of synthetic musks in indoor dust from China and implications for human exposure. Archives of Environmental Contamination and Toxicology 60(1):182-189.		
HERO ID:		2095404		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Mathematical Equations	Medium	Equations are referenced from a peer reviewed source and based on a scientifically sound approach.
	Metric 2:	Model Evaluation	Medium	Equations are referenced from a peer reviewed source and based on a scientifically sound approach; it is unknown if a more formal evaluation has taken place
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Medium	Samples were collected in 2009; between 5-15 years ago
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	Low	Reference for equation in not free to the public (Jones-Otazo et al. 2005)
	Metric 5:	Model Inputs and Defaults	Medium	Inputs are listed and values provided but little description is provide.
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	Medium	some discussion is included on variability and uncertainty
Overall Quality Determination			Medium	

Study Citation:		Shin, H. M., Mckone, T. E., Nishioka, M. G., Fallin, M. D., Croen, L. A., Hertz-Picciotto, I., Newschaffer, C. J., Bennett, D. H. (2014). Determining source strength of semivolatile organic compounds using measured concentrations in indoor dust. Indoor Air 24(3):260-271.		
HERO ID:		2215665		
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	Most equations provided in text, with additional equations and figures provided in the supplemental file with citations. Equations for surface area emission rates, gas/dust concentrations, and saturation concentrations.
	Metric 2:	Model Evaluation	Medium	All equations have peer reviewed citations, estimated emission rates only compared to reported values in two studies for DEHP.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Estimates and models relevant for plastics and building materials but not personal care products.
Domain 3: Accessibility/Clarity	Metric 4:	Model and Model Documentation Availability	High	Equations are all provided and supplemental documentation is available.
	Metric 5:	Model Inputs and Defaults	Medium	Inputs listed in supplemental table 2 and throughout paper after their relevant equations; most of the inputs are secondary or estimated.
Domain 4: Variability and Uncertainty	Metric 6:	Variability and Uncertainty	High	Uncertainty analysis conducted for the input variables.
Overall Quality Determination			High	

Study Citation:		Villa, S., Vighi, M., Finizio, A. (2014). Theoretical and experimental evidences of medium range atmospheric transport processes of polycyclic musk fragrances. Science of the Total Environment 481(1):27-34.		
HERO ID:		2541915		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	Model is originally published by OECD; equations are provided as reported in another study (Wegmann et al 2009)
	Metric 2:	Model Evaluation	High	Published by OECD
Domain 2: Representative	Metric 3:	Exposure Scenario	Low	Environmental exposure to HHCB may be relevant, but the specific scenarios put forth here might be particular to Italy/China/nearby areas
	Metric 4:	Model and Model Documentation Availability	High	Methods are described and link provides free download of tool and user manual
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	High	Inputs explained and values provided with citations
	Metric 6:	Variability and Uncertainty	Medium	Model assessed for urban and rural but only in two locations (Beijing China and Forni Glacier Italy); some discussion of uncertainties as related to Monte Carlo analysis
Overall Quality Determination		High		

Study Citation:		Calderón-Preciado, D., Matamoros, V., Bayona, J. M. (2011). Occurrence and potential crop uptake of emerging contaminants and related compounds in an agricultural irrigation network. Science of the Total Environment 412-413:14-19.		
HERO ID:		2919589		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	Low	Citations and explanation provided for the inputs to the concentration equations but the concentration equations themselves have no reference; intake equation provided but no reference.
	Metric 2:	Model Evaluation	Low	Predicted concentrations in tissue compared to an experimental study for subset of compounds measured (HHCB included).
Domain 2: Representative	Metric 3:	Exposure Scenario	Low	Intake via crops is a reasonable scenario but the intake via irrigation water might be more occupational than consumer. Crops were from NE Spain, so relevance to American diet may not be guaranteed.
	Metric 4:	Model and Model Documentation Availability	High	Equations provided as needed to replicate results, no user guide needed.
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	Medium	Inputs are given and most, but not all, have sources/references.
	Metric 6:	Variability and Uncertainty	Medium	Variability across crops discussed and uncertainties discussed such as hydrophobic and ionic compounds' behavior.
Overall Quality Determination		Low		

Study Citation: Wei, W., Mandin, C., Blanchard, O., Mercier, F., Pelletier, M., Le Bot, B., Glorennec, P., Ramalho, O. (2017). Predicting the gas-phase concentration of semi-volatile organic compounds from airborne particles: Application to a French nationwide survey. Science of the Total Environment 576(Elsevier):319-325.				
HERO ID: 3454652				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	Medium	Equations are all referenced from peer reviewed sources; Monte Carlo approach was also described.
	Metric 2:	Model Evaluation	Medium	Validation of new methods used was conducted by the authors.
Domain 2: Representative	Metric 3:	Exposure Scenario	Low	Data used in study was from 2003-2005.
Domain 3: Accessibility/Clarity	Metric 4:	Model and Model Documentation Availability	High	All reference equations used are not free to the public (e.g., Wei et al 2016a).
	Metric 5:	Model Inputs and Defaults	High	Inputs are all described (some are in supplemental material).
Domain 4: Variability and Uncertainty	Metric 6:	Variability and Uncertainty	High	Discussion included on uncertainty and variability.
Overall Quality Determination			Medium	

Study Citation:	Kapo, K. E., Deleo, P. C., Vamshi, R., Holmes, C. M., Ferrer, D., Dyer, S. D., Wang, X., White-Hull, C. (2016). iSTREEM({\textregistered}) : An approach for broad-scale in-stream exposure assessment of "down-the-drain" chemicals. Integrated Environmental Assessment and Management 12(4):782-792.			
HERO ID:	3466062			
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	Medium	Not all equations are provided but the methodology and theory are explained and sound
	Metric 2:	Model Evaluation	Medium	Modeled concentrations are compared against USGS data and methodology is compared against other existing models
Domain 2: Representative	Metric 3:	Exposure Scenario	High	Down the drain scenarios represent current exposure scenarios and cover a range of geographical areas/conditions
Domain 3: Accessibility/Clarity	Metric 4:	Model and Model Documentation Availability	High	Model is explained in study and user manual is available online for free with the model
	Metric 5:	Model Inputs and Defaults	High	Data sources for basis of model described; most inputs provided in paper, additional inputs can be found in supporting documentation
Domain 4: Variability and Uncertainty	Metric 6:	Variability and Uncertainty	High	Variability characterized in two example scenarios (filtered and unfiltered); uncertainties and limitations discussed in detail
Overall Quality Determination			High	

Study Citation:		Pelletier, M., Bonvallot, N., Ramalho, O., Blanchard, O., Mercier, F., Mandin, C., Le Bot, B., Glorennec, P. (2017). Dermal absorption of semivolatile organic compounds from the gas phase: Sensitivity of exposure assessment by steady state modeling to key parameters. Environment International 102:106-113.		
HERO ID:		3602893		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	Key equations are provided with citations where relevant
	Metric 2:	Model Evaluation	Medium	Modeled outputs compared to measured values to assess validity; base equations also reviewed in other studies
Domain 2: Representative	Metric 3:	Exposure Scenario	High	Dermal exposure/intake is likely to be part of an exposure scenario; products may include cleaning products, furniture, packaging etc.
	Metric 4:	Model and Model Documentation Availability	High	Most equations are provided but some intermediate steps are in the supplemental material
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	Medium	Most inputs are provided with citations or equations but not all are detailed
	Metric 6:	Variability and Uncertainty	High	Discussion of uncertainties and limitations in the sensitivity analysis
Overall Quality Determination		High		

Study Citation:		Pelletier, M., Bonvallot, N., Ramalho, O., Mandin, C., Wei, W., Raffy, G., Mercier, F., Blanchard, O., Le Bot, B., Glorennec, P. (2017). Indoor residential exposure to semivolatile organic compounds in France. Environment International 109:81-88.		
HERO ID:		4165791		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	Medium	All equations are cited and from peer reviewed sources.
	Metric 2:	Model Evaluation	High	Methods and Crystal Ball software are well known and have undergone evaluation.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Exposure data from previously published studies; 5-15 years ago.
	Metric 4:	Model and Model Documentation Availability	Low	All referenced materials for the modeling methods are not free and available to the public.
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	High	All inputs are defined and values referenced (when applicable); Crystal Ball was used I a probabilistic risk assessment so exact values are not always available.
	Metric 6:	Variability and Uncertainty	High	Included relative contribution of key parameters.
Overall Quality Determination		Medium		

Study Citation:		Cavalheiro, J., Zuloaga, O., Prieto, A., Preudhomme, H., Amouroux, D., Monperrus, M. (2017). Occurrence and Fate of Organic and Organometallic Pollutants in Municipal Wastewater Treatment Plants and Their Impact on Receiving Waters (Adour Estuary, France). Archives of Environmental Contamination and Toxicology 73(4):619-630.		
HERO ID:		4196927		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	Low	Eq 1 was from a peer reviewed source; Eq 2 was not referenced but was based on a scientifically sound approach
	Metric 2:	Model Evaluation	Low	Equations are in peer reviewed literature; no formal evaluation was mention in paper.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Samples taken in 2013 - between 5 - 15 years ago
	Metric 4:	Model and Model Documentation Availability	Low	referenced treatment removal equation is from a textbook that is not publicly available for free
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	High	Inputs are clearly defined and values are provided and referenced when applicable.
	Metric 6:	Variability and Uncertainty	High	discussion included on variability and uncertainty; included different months
Overall Quality Determination		Medium		

Study Citation:		Wei, W., Mandin, C., Blanchard, O., Mercier, F., Pelletier, M., Le Bot, B., Glorennec, P., Ramalho, O. (2019). Semi-volatile organic compounds in French dwellings: An estimation of concentrations in the gas phase and particulate phase from settled dust. Science of the Total Environment 650 Pt. 2:2742-2750.		
HERO ID:		5043472		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	Medium	Concentration and intermediate equations provided with citations and explanations.
	Metric 2:	Model Evaluation	Medium	Validation through comparing predicted and measured values with previous studies in similar environments/conditions; high R2 values for gas phase conc and particular phase equations/values.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Exposure to SVOCs via indoor dust is a relevant and current exposure scenario, but this study and methods are based on data inside French homes.
	Metric 4:	Model and Model Documentation Availability	High	Equations all detailed and cited, can be followed to repeat the process.
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	High	Inputs to all equations provided and cited where applicable.
	Metric 6:	Variability and Uncertainty	Medium	Variability and uncertainty in results discussed for different chemicals based on reported concentrations (secondary data) and equilibrium of gaseous/particulate phases.
Overall Quality Determination		Medium		

Study Citation:		Zhang, X., Yao, Y.,u, Zeng, X., Qian, G., Guo, Y., Wu, M., Sheng, G., Fu, J. (2008). Synthetic musks in the aquatic environment and personal care products in Shanghai, China. Chemosphere 72(10):1553-1558.		
HERO ID:		5427894		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	Low	Some equations are not references, but these are based on scientifically sound approaches.
	Metric 2:	Model Evaluation	Low	some equations are from peer reviewed sources and comparison with previous concentration estimates was included but the only evaluation mentioned was conducted by author.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Sampling was conducted in 2007 - between 5-15 years ago
	Metric 4:	Model and Model Documentation Availability	Low	All equations are not referenced
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	High	Model inputs are defined and values are provided and referenced when applicable.
	Metric 6:	Variability and Uncertainty	Low	very limited discussion on variability and uncertainty
Overall Quality Determination		Low		

Study Citation:		Tseng, W. J., Tsai, S. W. (2019). Assessment of dermal exposures for synthetic musks from personal care products in Taiwan. Science of the Total Environment 669:160-167.		
HERO ID:		5427988		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	Medium	exposure equation is referenced from a peer reviewed source
	Metric 2:	Model Evaluation	Medium	Equation came from a peer reviewed source, no more formal evaluation was mentioned
Domain 2: Representative	Metric 3:	Exposure Scenario	High	Product concentrations were recent (within 5 years)
	Metric 4:	Model and Model Documentation Availability	Low	Reference for exposure equation (Slania 2004) is not freely available to the public.
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	High	all inputs are defined, values provided, and referenced when applicable
	Metric 6:	Variability and Uncertainty	Medium	some discussion included on variability and uncertainty.
Overall Quality Determination		Medium		

Study Citation:		Schwartz, S., Berding, V., Matthies, M. (2000). Aquatic fate assessment of the polycyclic musk fragrance HHCB - Scenario and variability analysis in accordance with the EU risk assessment guidelines. Chemosphere 41(5):671-679.		
HERO ID:		5428093		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	Medium	The model used is EUSES, which appears to be a well-known risk assessment model from Europe. However, this particular paper does not get into the mathematical basis or theory behind EUSES.
	Metric 2:	Model Evaluation	High	The EUSES model seems to be widely known and used, and can be assumed to have undergone evaluation.
Domain 2: Representative	Metric 3:	Exposure Scenario	Low	The model was developed in Europe, and is being compared against monitoring data from Germany. The paper was published in 1999. The surface water and fish body weight results appear to be relevant scenarios.
	Metric 4:	Model and Model Documentation Availability	High	The EUSES model seems to be easily available online.
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	Low	The paper is not clear on what values were used as inputs to generate the EUSES model data.
	Metric 6:	Variability and Uncertainty	High	The paper provides an uncertainty analysis and a variability analysis, and discusses how the model outputs compare with monitoring data.
Overall Quality Determination		Medium		

Study Citation:		Ortiz de Garcia, S., Pinto Pinto, G., Garcia Encina, P., Irusta Mata, R. (2013). Consumption and occurrence of pharmaceutical and personal care products in the aquatic environment in Spain. Science of the Total Environment 444(Elsevier):451-465.		
HERO ID:		5428125		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	PEC calculation is provided in Eqn 9 and terms are described.
	Metric 2:	Model Evaluation	Medium	May be foreign-developed model (EU). PEC and MEC were compared for verification of model. Mass-balance approach was also mentioned.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	2013 study from Spain; HHCB use patterns & WWT practices may vary from US.
	Metric 4:	Model and Model Documentation Availability	High	Reference citations provided with discussion. PEC equation adapted from Kostich et al (2010) and agrees with model from European Medicine Agency (EMA 2006), which is publicly available. Also uses USEPA STPWIN model (USEPA 2009) for WWTP removal rate input parameter.
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	Medium	Model inputs, defaults and data sources are described. Checks and comparisons support appropriateness of model. Sometimes difficult to follow what parts of study apply to pharmaceuticals vs PCPS/HHCB.
	Metric 6:	Variability and Uncertainty	Medium	Robust discussion of variability and uncertainty. Uncertainties identified in terms of WWTP removal rates using STPWIN model and potential differences in consumption/use patterns and WWT practices for geographic areas outside of Spain.
Overall Quality Determination		Medium		

Study Citation: Homem, V., Silva, E., Alves, A., Santos, L. (2015). Scented traces - Dermal exposure of synthetic musk fragrances in personal care products and environmental input assessment. Chemosphere 139:276-287.				
HERO ID: 5428335				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	Medium	dermal exposure and down the drain calculations were referenced and from peer reviewed sources
	Metric 2:	Model Evaluation	Low	evaluation was done by the author - compared to literature values; no more formal evaluation was mentioned
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Sampling for exposure based on products purchase in 2012
	Metric 4:	Model and Model Documentation Availability	Low	References for equations are not all available to the public for free
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	High	All inputs are described and cited
	Metric 6:	Variability and Uncertainty	High	Paper discussed variability and uncertainty
Overall Quality Determination			Medium	

Study Citation:		Cunha, S. C., Trabalón, L., Jacobs, S., Castro, M., Fernandez-Tejedor, M., Granby, K., Verbeke, W., Kwadijk, C., Ferrari, F., Robbens, J., Sioen, I., Pocurull, E., Marques, A., Fernandes, J. O., Domingo, J. L. (2018). UV-filters and musk fragrances in seafood commercialized in Europe Union: Occurrence, risk and exposure assessment. Environmental Research 161:399-408.		
HERO ID:		5428404		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	Equation is provided and described with citation for methodology (Jacobs et al., 2017)
	Metric 2:	Model Evaluation	Low	Evaluation not conducted in the study but assumption of evaluation in peer review.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Publication and data presented are 2017. But the data are all from European countries and may not translate to US estimates.
	Metric 4:	Model and Model Documentation Availability	Low	The probability approach and the deterministic approach were used but does not specify how used or on which datasets. Sample data and dataset data are combined for concentrations but the data are not delineated to their source.
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	Low	Inputs are described for exposure calculations but concentration and consumption data are not provided. Data quality criteria are not discussed.
	Metric 6:	Variability and Uncertainty	Medium	Data covers multiple countries and variety of fish. But in the presented data the results are only presented for one country.
Overall Quality Determination		Low		

Study Citation:		Berding, V., Koormann, F., Schwartz, S., Wagner, J. O., Matthies, M. (2001). Spatial refinement of regional exposure assessment. NATO Science Series IV Earth and Environmental Sciences 2:205-222.		
HERO ID:		5428645		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	EUSES - multiple models/modules. The EU ECHA provides the technical guidance on the model. There is also technical guidance on GREAT-ER. These are widely accepted models from trusted sources.
	Metric 2:	Model Evaluation	Medium	EUSES and GREAT-ER have undergone evaluation individually, but the application of the two models together as described in the paper is a new approach. The paper evaluated this by comparing to monitoring data.
Domain 2: Representative	Metric 3:	Exposure Scenario	Low	Paper and data used is >15 years old and focused on spatial refinement to the model based on European geographic regions
Domain 3: Accessibility/Clarity	Metric 4:	Model and Model Documentation Availability	High	EUSES and GREAT-ER along with the technical guidance documenters are all free and available to the public
	Metric 5:	Model Inputs and Defaults	High	Model requirements/inputs/defaults are all described and recorded for the use of both models.
Domain 4: Variability and Uncertainty	Metric 6:	Variability and Uncertainty	High	Modeled data is compared to monitoring data and variability and uncertainty associated with the model is then discussed.
Overall Quality Determination		High		

Study Citation:		Federle, T., Sun, P., Dyer, S., Kiel, B. (2014). Probabilistic assessment of environmental exposure to the polycyclic musk, HHCB and associated risks in wastewater treatment plant mixing zones and sludge amended soils in the United States. Science of the Total Environment 493:1079-1087.		
HERO ID:		5431413		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	All mathematical equations and sub equations are provided and cited as needed
	Metric 2:	Model Evaluation	Medium	Equations used in the model were either cited directly or were based off of previously cited models and methods
Domain 2: Representative	Metric 3:	Exposure Scenario	High	Inputs used are for the various relevant conditions: mixing zones downstream from WWTP and sludge amended soils. All inputs were used in the various formulas to reach the relevant data outputs
	Metric 4:	Model and Model Documentation Availability	High	Most of the model calculations are based on previous modeling papers. some of the calculations and values are provided initially in this study with background and include what other method they are based on
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	High	Inputs are provided and cited as needed. Table 1 is for the WWTP mixing zones and Table 2 is for the sludge amended soils
	Metric 6:	Variability and Uncertainty	Medium	sensitivity analysis conducted on the various outputs but an uncertainty factor is applied to outputs to account for potential issues
Overall Quality Determination		High		

Study Citation:		Hubbard, H. F., Ring, C. L., Hong, T., Henning, C. C., Vallero, D. A., Egeghy, P. P., Michael-Rock, G. (2022). Exposure Prioritization (Ex Priori): A screening-level high-throughput chemical prioritization tool. Toxics 10(10):569.		
HERO ID:		12952530		
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	All equations were provided in the spreadsheet and methodologies were discussed in the paper. Sound methods were used for purpose of developing a screening level prioritization model.
	Metric 2:	Model Evaluation	Medium	The paper is published in the peer reviewed journal "toxics". the paper evaluated the model by comparing to NHANES-Inferred Exposures. The results showed that the estimates are biased high. However, Ex Priori appears to perform comparably to another rapid exposure model (SEEM3) when the predictions of both models are evaluated by examining their correlation to median aggregate exposure rates for the U.S. population inferred from NHANES urine biomonitoring data.
Domain 2: Representative	Metric 3:	Exposure Scenario	High	By default, Ex Priori models the baseline exposure scenario of an average adult consumer, including average consumer habits and practices. Ex Priori considers multi-chemical exposures from consumer products and articles accounting for product formulation and use; physical-chemical properties, such as partition coefficients; and user exposure factors and activity patterns. Product composition data were collected from the Consumer Product Chemical Profiles database (CPCPdb). Habits and practices data for each of the consumer products are harmonized with SHEDS-HT as presented in Isaacs et al.
Domain 3: Accessibility/Clarity	Metric 4:	Model and Model Documentation Availability	High	The model is available in spreadsheet format with all equations transparent. All sources are described in the paper.
	Metric 5:	Model Inputs and Defaults	High	Model inputs are clearly described and sources cited. Commonly accepted inputs were used.
Domain 4: Variability and Uncertainty	Metric 6:	Variability and Uncertainty	High	Uncertainties and limitations are noted and implications discussed. Authors suggest the tool should be used as a screening level prioritization tool. Limitations include the use of constant emissions rate rather than time-dependent emission rate, assumptions that products are liquids, over simplified dermal uptake, and use of older product data gathered in 2015.
Overall Quality Determination			High	

Glossary of Select Terms for Data Evaluation Tables

Table 248: Glossary of Select Terms for Data Evaluation

Term	Definition
30Q5	Lowest 30-day average flow that occurs (on average) once every 5 years
ACH	Air exchange rate
ADC	Average daily concentration
ADD	Average daily dose
ADME	Absorption, distribution, metabolism, and excretion
AF	Assessment factor
APDR	Acute potential dose rate
BCF	Bioconcentration factor
BLS	Bureau of Labor Statistics (U.S.)
CADD	Chronic average daily dose
CASRN	Chemical Abstracts Service Registry Number
CDR	Chemical Data Reporting
CEM	Consumer Exposure Model
ChemSTEER	Chemical Screening Tool for Exposure and Environmental Releases
COU	Condition of use
CPS	Current Population Survey
DTD	Down-the-drain
EPA	Environmental Protection Agency
FDA	Food and Drug Administration
HHCB	1,3,4,6,7,8-Hexahydro-4,6,6,7,8,8-hexamethylcyclopenta[γ]-2-benzopyran
IADD	Intermediate average daily dose
KABAM	K_{OW} (based) Aquatic BioAccumulation Model
K_{OW}	Octanol: water partition coefficient
LADC	Lifetime average daily concentration
MCCEM	Multi-chamber concentration
NAICS	North American Industry Classification System
OAQPS	Office of Air Quality Planning and Standards (EPA)
OCSPP	Office of Chemical Safety and Pollution Prevention
OECD	Organisation for Economic Co-operation and Development
OPPT	Office of Pollution Prevention and Toxics
OSHA	Occupational Safety and Health Administration
PESS	Potentially exposed or susceptible subpopulation(s)
PNOR	Particulates not otherwise regulated
POD	Point(s) of departure
POTW	Publicly owned treatment works
PSC	Point Source Calculator

Continued on next page ...

Glossary of Select Terms for Data Evaluation Tables

Table 248 ...continued from previous page

Term	Definition
ReCAAP	Rethinking Chronic Toxicity and Carcinogenicity Assessment for Agrochemicals Project
SHEDS-HT	Stochastic Human Exposure and Dose Simulations-High Throughput
SIC	Standard Industrial Code
SIPP	Survey of Income and Program Participation
SWC	Surface water concentration
TRI	Toxics Release Inventory
TSD	Technical support document
TSCA	Toxic Substances Control Act
TWA	Time-weighted average
U.S.	United States
VVWM	Variable Volume Water Model
w/w	Weight by weight
WWT	Wastewater treatment