United States
Environmental Protection Agency

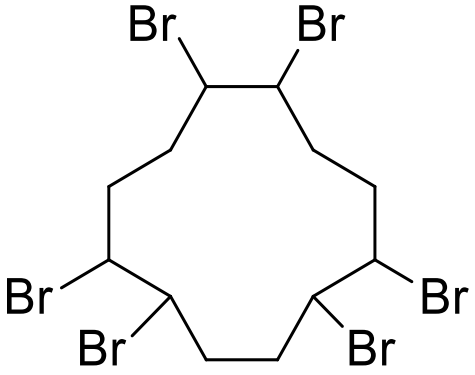
Office of Chemical Safety and
Pollution Prevention

Final Risk Evaluation for Cyclic Aliphatic Bromides Cluster (HBCD)

Systematic Review Supplemental File:

Data Quality Evaluation for Fate and Transport Studies

CASRN: 25637-99-4
CASRN: 3194-55-6
CASRN: 3194-57-8



September 2020

Table of Contents

Janák, K; Sellström, U; Johansson, AK; Becher, G; de Wit, CA; Lindberg, P; Helander, B. (2008). Enantiomer-specific accumulation of hexabromocyclododecanes in eggs of predatory birds. Chemosphere 73: S193-S200. http://dx.doi.org/10.1016/j.chemosphere.2007.03.077. HERO ID: 1927746 38
Sørmo, EG; Salmer, MP; Jenssen, BM; Hop, H; Baek, K; Kovacs, KM; Lydersen, C; Falk-Petersen, S; Gabrielsen, GW; Lie, E; Skaare, JU. (2006). Biomagnification of polybrominated diphenyl ether and hexabromocyclododecane flame retardants in the polar bear food chain in Svalbard, Norway. Environ Toxicol Chem 25: 2502-2511. http://dx.doi.org/10.1897/05-591R.1. HERO ID: 1927787.....41
Li, B; Yao, T; Sun, H; Zhang, Y; Yang, J. (2016). Diastereomer- and enantiomer-specific accumulation, depuration, bioisomerization, and metabolism of hexabromocyclododecanes (HBCDs) in two ecologically different species of earthworms. Sci Total Environ 542: 427-434. http://dx.doi.org/10.1016/j.scitotenv.2015.10.100. HERO ID: 3350510 43
Zhu, C; Wang, P; Li, Y; Chen, Z; Li, H; Ssebugere, P; Zhang, Q; Jiang, G. (2017). Trophic transfer of hexabromocyclododecane in the terrestrial and aquatic food webs from an e-waste dismantling region in East China. Environ Sci Process Impacts 19: 154-160. http://dx.doi.org/10.1039/c6em00617e. HERO ID: 3546047 45
U.S. EPA (U.S. Environmental Protection Agency). (2017). IUCLID data set: hexbromocyclododecane. Retrieved from https://java.epa.gov/oppt_chemical_search/. HERO ID: 3970216.....47
U.S. EPA (U.S. Environmental Protection Agency). (2002). EPA HPV Track: 1,2,5,6,9,10-Hexabromocyclododecane. https://java.epa.gov/oppt_chemical_search/. HERO ID: 3970217 49
Wu, JP; Guan, YT; Zhang, Y; Luo, XJ; Zhi, H; Chen, SJ; Mai, BX. (2011). Several current-use, non-PBDE brominated flame retardants are highly bioaccumulative: evidence from field determined bioaccumulation factors. Environ Int 37: 210-215. http://dx.doi.org/10.1016/j.envint.2010.09.006. HERO ID: 1443814 51
Wu, JP; Guan, YT; Zhang, Y; Luo, XJ; Zhi, H; Chen, SJ; Mai, BX. (2011). Several current-use, non-PBDE brominated flame retardants are highly bioaccumulative: evidence from field determined bioaccumulation factors. Environ Int 37: 210-215. http://dx.doi.org/10.1016/j.envint.2010.09.006. HERO ID: 1443814 53
Wu, JP; Guan, YT; Zhang, Y; Luo, XJ; Zhi, H; Chen, SJ; Mai, BX. (2011). Several current-use, non-PBDE brominated flame retardants are highly bioaccumulative: evidence from field determined bioaccumulation factors. Environ Int 37: 210-215. http://dx.doi.org/10.1016/j.envint.2010.09.006. HERO ID: 1443814 54
Ismail, N; Gewurtz, SB; Pleskach, K; Whittle, DM; Helm, PA; Marvin, CH; Tomy, GT. (2009). Brominated and chlorinated flame retardants in Lake Ontario, Canada, lake trout (Salvelinus namaycush) between 1979 and 2004 and possible influences of food- web changes. Environ Toxicol Chem 28: 910-920. http://dx.doi.org/10.1897/08-162.1. HERO ID: 1443833.....57
Ismail, N; Gewurtz, SB; Pleskach, K; Whittle, DM; Helm, PA; Marvin, CH; Tomy, GT. (2009). Brominated and chlorinated flame retardants in Lake Ontario, Canada, lake trout (Salvelinus namaycush) between 1979 and 2004 and possible influences of food- web changes. Environ Toxicol Chem 28: 910-920. http://dx.doi.org/10.1897/08-162.1. HERO ID: 1443833.....59
Ismail, N; Gewurtz, SB; Pleskach, K; Whittle, DM; Helm, PA; Marvin, CH; Tomy, GT. (2009). Brominated and chlorinated flame retardants in Lake Ontario, Canada, lake trout (Salvelinus namaycush) between 1979 and 2004 and possible influences of food- web changes. Environ

Toxicol Chem 28: 910-920. http://dx.doi.org/10.1897/08-162.1. HERO ID: 1443833.....61
Tomy, GT; Pleskach, K; Oswald, T; Halldorson, T; Helm, PA; Macinnis, G; Marvin, CH. (2008). Enantioselective bioaccumulation of hexabromocyclododecane and congener-specific accumulation of brominated diphenyl ethers in an eastern Canadian Arctic marine food web. Environ Sci Technol 42: 3634-3639. http://dx.doi.org/10.1021/es703083z. HERO ID: 1443836.....63
Law, K; Palace, VP; Halldorson, T; Danell, R; Wautier, K; Evans, B; Alaee, M; Marvin, C; Tomy, GT. (2006). Dietary accumulation of hexabromocyclododecane diastereoisomers in juvenile rainbow trout (Oncorhynchus mykiss). I: Bioaccumulation parameters and evidence of bioisomerization. Environ Toxicol Chem 25: 1757. http://dx.doi.org/10.1897/05-445r.1. HERO ID: 1443861.....65
ACC (American Chemistry Council). (2005). HPV data summary and test plan for hexabromocyclododecane (HBCD). Arlington, VA: Brominated Flame Retardant Industry Panel (BFRIP), American Chemistry Council. http://www.epa.gov/oppt/chemrtk/pubs/summaries/cyclodod/c13459tc.htm. HERO ID: 1443881.....67
He, MJ; Luo, XJ; Yu, LH; Wu, JP; Chen, SJ; Mai, BX. (2013). Diasteroisomer and enantiomer-specific profiles of hexabromocyclododecane and tetrabromobisphenol A in an aquatic environment in a highly industrialized area, South China: vertical profile, phase partition, and bioaccumulation. Environ Pollut 179: 105-110. http://dx.doi.org/10.1016/j.envpol.2013.04.016. HERO ID: 1927551.....70
La Guardia, MJ; Hale, RC; Harvey, E; Mainor, TM; Ciparis, S. (2012). In situ accumulation of HBCD, PBDEs, and several alternative flame-retardants in the bivalve (Corbicula fluminea) and gastropod (Elimia proxima). Environ Sci Technol 46: 5798-5805. http://dx.doi.org/10.1021/es3004238. HERO ID: 1927601.....72
Haukås, M; Hylland, K; Nygård, T; Berge, JA; Mariussen, E. (2010). Diastereomer-specific bioaccumulation of hexabromocyclododecane (HBCD) in a coastal food web, Western Norway. Sci Total Environ 408: 5910-5916. http://dx.doi.org/10.1016/j.scitotenv.2010.08.026. HERO ID: 1927667.....74
Wu, JP; Guan, YT; Zhang, Y; Luo, XJ; Zhi, H; Chen, SJ; Mai, BX. (2010). Trophodynamics of hexabromocyclododecanes and several other non-PBDE brominated flame retardants in a freshwater food web. Environ Sci Technol 44: 5490-5495. http://dx.doi.org/10.1021/es101300t. HERO ID: 1927678.....76
Wu, JP; Guan, YT; Zhang, Y; Luo, XJ; Zhi, H; Chen, SJ; Mai, BX. (2010). Trophodynamics of hexabromocyclododecanes and several other non-PBDE brominated flame retardants in a freshwater food web. Environ Sci Technol 44: 5490-5495. http://dx.doi.org/10.1021/es101300t. HERO ID: 1927678.....77
Wu, JP; Guan, YT; Zhang, Y; Luo, XJ; Zhi, H; Chen, SJ; Mai, BX. (2010). Trophodynamics of hexabromocyclododecanes and several other non-PBDE brominated flame retardants in a freshwater food web. Environ Sci Technol 44: 5490-5495. http://dx.doi.org/10.1021/es101300t. HERO ID: 1927678.....79
Kim, GB; Stapleton, HM. (2010). PBDEs, methoxylated PBDEs and HBCDs in Japanese common squid (Todarodes pacificus) from Korean offshore waters. Mar Pollut Bull 60: 935-940. http://dx.doi.org/10.1016/j.marpolbul.2010.03.025. HERO ID: 1927684.....81
Harrad, S; Abdallah, MA; Rose, NL; Turner, SD; Davidson, TA. (2009). Current-use brominated flame retardants in water, sediment, and fish from English lakes. Environ Sci Technol 43:

natural compounds and alternative flame retardants in three delphinids from Southern European waters. Environ Pollut 203: 107-115. http://dx.doi.org/10.1016/j.envpol.2015.03.041. HERO ID: 3327242.....112
Baron, E; Gimenez, J; Verborgh, R; Gauffier, P; De Stephanis, R; Eljarrat, E; Barcelo, D. (2015). Bioaccumulation and biomagnification of classical flame retardants, related halogenated natural compounds and alternative flame retardants in three delphinids from Southern European waters. Environ Pollut 203: 107-115. http://dx.doi.org/10.1016/j.envpol.2015.03.041. HERO ID: 3327242.....114
Tang, B; Zeng, YH; Luo, XJ; Zheng, XB; Mai, BX. (2015). Bioaccumulative characteristics of tetrabromobisphenol A and hexabromocyclododecanes in multi-tissues of prey and predator fish from an e-waste site, South China. Environ Sci Pollut Res Int 22: 12011- 12017. http://dx.doi.org/10.1007/s11356-015-4463-1. HERO ID: 3350534.....116
Zhu, C; Wang, P; Li, Y; Chen, Z; Li, H; Ssebugere, P; Zhang, Q; Jiang, G. (2017). Trophic transfer of hexabromocyclododecane in the terrestrial and aquatic food webs from an e-waste dismantling region in East China. Environ Sci Process Impacts 19: 154-160. http://dx.doi.org/10.1039/c6em00617e. HERO ID: 3546047.....118
Zhu, H; Zhang, K; Sun, H; Wang, F; Yao, Y. (2017). Spatial and temporal distributions of hexabromocyclododecanes in the vicinity of an expanded polystyrene material manufacturing plant in Tianjin, China. Environ Pollut 222: 338-347. http://dx.doi.org/10.1016/j.envpol.2016.12.029. HERO ID: 3546055.....120
Guerra, P; De La Cal, A; Marsh, G; Eljarrat, E; Barcelo, D. (2009). Transfer of hexabromocyclododecane from industrial effluents to sediments and biota: Case study in Cinca River (Spain). J Hydrol 369: 360-367. http://dx.doi.org/10.1016/j.jhydrol.2009.02.024. HERO ID: 3575325.....122
U.S. EPA (U.S. Environmental Protection Agency). (2017). IUCLID data set: hexbromocyclododecane. Retrieved from https://java.epa.gov/oppt_chemical_search/. HERO ID: 3970216.....125
ECHA (European Chemicals Agency). (2017). Bioaccumulation: aquatic/sediment: hexabromocyclododecane. Helsinki, Finland. Retrieved from https://echa.europa.eu/registration-dossier/-/registered-dossier/15003/5/4/2#. HERO ID: 3970741.....128
ECHA (European Chemicals Agency). (2017). Bioaccumulation: aquatic/sediment: hexabromocyclododecane. Helsinki, Finland. Retrieved from https://echa.europa.eu/registration-dossier/-/registered-dossier/15003/5/4/2#. HERO ID: 3970741.....130
ECHA (European Chemicals Agency). (2017). Bioaccumulation: aquatic/sediment: hexabromocyclododecane. Helsinki, Finland. Retrieved from https://echa.europa.eu/registration-dossier/-/registered-dossier/15003/5/4/2#. HERO ID: 3970741.....132
Law, K; Halldorson, T; Danell, R; Stern, G; Gewurtz, S; Alaee, M; Marvin, C; Whittle, M; Tomy, G. (2007). Erratum: Bioaccumulation and trophic transfer of some brominated flame retardants in a Lake Winnipeg (Canada) food web. Environ Toxicol Chem 26: 190. http://dx.doi.org/10.1002/etc.5620260125. HERO ID: 4140418.....135
Chemicals Inspection and Testing Institute Japan. (1995). Final report: Bioconcentration study of hexabromocyclododecane in carp conducted with 1,2,5,6,9,10- hexabromocyclododecane (test substance no. K-1035). Chemical Biotesting Center, Kurume Laboratory. HERO ID:

1443881 214
ACC (American Chemistry Council). (2005). HPV data summary and test plan for hexabromocyclododecane (HBCD). Arlington, VA: Brominated Flame Retardant Industry Panel (BFRIP), American Chemistry Council. http://www.epa.gov/oppt/chemrtk/pubs/summaries/cyclodod/c13459tc.htm. HERO ID: 1443881 217
Hu, J; Jin, J; Wang, Y; Ma, Z; Zheng, W. (2011). Levels of polybrominated diphenyl ethers and hexabromocyclododecane in the atmosphere and tree bark from Beijing, China. Chemosphere 84: 355-360. http://dx.doi.org/10.1016/j.chemosphere.2011.04.002. HERO ID: 1927637 220
Hermanson, MH; Isaksson, E; Forsström, S; Teixeira, C; Muir, DC; Pohjola, VA; van de Wal, RS. (2010). Deposition history of brominated flame retardant compounds in an ice core from Holtedahlfonna, Svalbard, Norway. Environ Sci Technol 44: 7405-7410. http://dx.doi.org/10.1021/es1016608. HERO ID: 1927665 222
Haukås, M; Mariussen, E; Ruus, A; Tollefsen, KE. (2009). Accumulation and disposition of hexabromocyclododecane (HBCD) in juvenile rainbow trout (Oncorhynchus mykiss). Aquat Toxicol 95: 144-151. http://dx.doi.org/10.1016/j.aquatox.2009.08.010. HERO ID: 1927701 224
Harrad, S; Abdallah, MA; Covaci, A. (2009). Causes of variability in concentrations and diastereomer patterns of hexabromocyclododecanes in indoor dust. Environ Int 35: 573-579. http://dx.doi.org/10.1016/j.envint.2008.10.005. HERO ID: 1927725 227
Ichihara, M; Yamamoto, A; Takakura, K; Kakutani, N; Sudo, M. (2014). Distribution and pollutant load of hexabromocyclododecane (HBCD) in sewage treatment plants and water from Japanese Rivers. Chemosphere 110: 78-84. http://dx.doi.org/10.1016/j.chemosphere.2014.03.074. HERO ID: 2343678 229
Takigami, H; Watanabe, M; Kajiwara, N. (2014). Destruction behavior of hexabromocyclododecanes during incineration of solid waste containing expanded and extruded polystyrene insulation foams. Chemosphere 116: 24-33. http://dx.doi.org/10.1016/j.chemosphere.2014.01.082. HERO ID: 2343703 231
Zhou, D; Wu, Y; Feng, X; Chen, Y; Wang, Z; Tao, T; Wei, D. (2014). Photodegradation of hexabromocyclododecane (HBCD) by Fe(III) complexes/H2O 2 under simulated sunlight. Environ Sci Pollut Res Int 21: 6228-6233. http://dx.doi.org/10.1007/s11356- 014-2553-0. HERO ID: 2343710 233
Arinaitwe, K; Muir, DC; Kiremire, BT; Fellin, P; Li, H; Teixeira, C. (2014). Polybrominated diphenyl ethers and alternative flame retardants in air and precipitation samples from the northern Lake Victoria region, East Africa. Environ Sci Technol 48: 1458-1466. http://dx.doi.org/10.1021/es403600a. HERO ID: 2343716 235
Zhang, Y; Sun, H; Liu, F; Dai, Y; Qin, X; Ruan, Y; Zhao, L; Gan, Z. (2013). Hexabromocyclododecanes in limnic and marine organisms and terrestrial plants from Tianjin, China: diastereomer- and enantiomer-specific profiles, biomagnification, and human exposure. Chemosphere 93: 1561-1568. http://dx.doi.org/10.1016/j.chemosphere.2013.08.004. HERO ID: 2343741 237
Schreder, ED; La Guardia, MJ. (2014). Flame retardant transfers from U.S. households (dust and laundry wastewater) to the aquatic environment. Environ Sci Technol 48: 11575-11583. http://dx.doi.org/10.1021/es502227h. HERO ID: 2528320 239
Rauert, C; Harrad, S; Stranger, M; Lazarov, B. (2014). Test chamber investigation of the

Study Reference:	U.S. E. P. A. (2009). User's guide and technical documentation: KABAM version 1.0 (Kow (base199d) Aquatic BioAccumulation Model). HERO ID: 5102068					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
Test Design	3. Study Controls	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
	4. Test Substance Stability	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
Test Conditions	5. Test Method Suitability	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
	6. Testing Conditions	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
	7. Testing Consistency	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
	8. System Type and Design	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
	12. Sampling Methods	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
Confounding/ Variable Control	13. Confounding Variables	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
	16. Statistical Methods and Kinetic	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR

Other	17. Verification or Plausibility of Results	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
	18. QSAR Models	High	The KABAM (K_{OW} (based) Aquatic BioAccumulation Model) model has defined endpoints. Chemical domain, uncertainties and performance of the model is reported. Unambiguous algorithms are available in the model documentation and/or cited references to establish their scientific validity. KABAM models.	1	1	1
			Sum of scores:	2	3	1
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1	**Overall Score (Rounded):**	1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	ECHA (European Chemicals Agency). (2017). Adsorption/desorption: hexabromocyclododecane. Helsinki, Finland. Retrieved from https://echa.europa.eu/registration-dossier/-/registered-dossier/15003/5/5/2#. HERO ID: 3970742					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by CASRN and common name.	1	2	2
	2. Test Substance Purity	High	The test substance source and purity were reported.	1	1	1
Test Design	3. Study Controls	Not rated	The study did not require concurrent control groups.	NR	NR	NR
	4. Test Substance Stability	High	The test substance storage conditions were reported; stored in the dark between 15 and 25°C.	1	1	1
Test Conditions	5. Test Method Suitability	Low	OECD 121 can only determine log Koc between 1 and 5; OECD 106 would have been a more appropriate test.	3	1	3
	6. Testing Conditions	Medium	Some testing conditions were reported, and a guideline method was used.	2	2	4
	7. Testing Consistency	Not rated	Limited details were reported in this secondary source; however, primary source may contain more detail.	NR	NR	NR
	8. System Type and Design	Medium	The reference standards were appropriate for this type of test but did not extend to cover log Koc of the test material	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	High	Followed two testing guidelines (OECD 121 and EU Method C.19) for the estimation of Koc.	1	1	1
	12. Sampling Methods	Not rated	Limited details were reported in this secondary source; however, the primary source may contain more detail.	NR	NR	NR
Confounding / Variable Control	13. Confounding Variables	Low	Because the log Koc for the test item lies outside the calibration range, only a relative value could be obtained.	3	1	3
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Analytical method was suitable for detection of test material.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	Statistical method was clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	Medium	Only an estimated range for HBCD Koc was reported as the retention time fell outside the calibration range defined by the 8 reference substances.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	18	14	22
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.57	**Overall Score (Rounded):**	1.6
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Letcher, RJ; Gebbink, WA; Sonne, C; Born, EW; Mckinney, MA; Dietz, R. (2009). Bioaccumulation and biotransformation of brominated and chlorinated contaminants and their metabolites in ringed seals (Pusa hispida) and polar bears (Ursus maritimus) from East Greenland. Environ Int 35: 1118-1124. http://dx.doi.org/10.1016/j.envint.2009.07.006. HERO ID: 1443826					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	The test substance was identified by analytical means. The source and purity of the analytical reference material was not provided.	2	1	2
Test Design	3. Study Controls	High	QA/QC procedures were included in this study.	1	2	2
	4. Test Substance Stability	High	The test substance stability was accounted for and appropriate for the study.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	Medium	Only one isomer was evaluated in this study; this may decrease the value of the results.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Test organism information was reported.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study.	1	1	1

	12. Sampling Methods	High	Extraction and clean up procedure details were referenced to the primary source; however, some details were provided.	1	1	1
Confounding / Variable Control	13. Confounding Variables	Medium	Only one isomer was evaluated in this study	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Some information was not reported (i.e., all forms of the target chemical and transformation products); however, these omissions were not likely to have had a substantial impact on the study results.	2	2	4
	16. Statistical Methods and Kinetic Calculations	High	The analysis of data was clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	19	20	25
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.25	**Overall Score (Rounded):**	1.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Yu, L; Luo, X; Zheng, X; Zeng, Y; Chen, D; Wu, J; Mai, B. (2013). Occurrence and biomagnification of organohalogen pollutants in two terrestrial predatory food chains. Chemosphere 93: 506-511. http://dx.doi.org/10.1016/j.chemosphere.2013.06.023. HERO ID: 1927541					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	Source and purity were not reported; determination of the enantiomeric fractions were in the Supplemental Information.	2	1	2
Test Design	3. Study Controls	Not rated	Field study/monitoring; the study did not include control groups. Details of QA/QC were provided as supplemental information.	NR	NR	NR
	4. Test Substance Stability	Medium	Details regarding this metric were omitted; however, this was not likely to have had a substantial impact on the results.	2	1	2
Test Conditions	5. Test Method Suitability	Low	Details regarding test method suitability were limited/omitted (specifically, information on the identification/quantitation of HBCD enantiomers); the lack of information made this study difficult to interpret.	3	1	3
	6. Testing Conditions	Medium	Details regarding test condition were limited/omitted. Such details were referenced to a prior study and supplemental information.	2	2	4
	7. Testing Consistency	Not rated	This information was not provided in the publication.	NR	NR	NR
	8. System Type and Design	Medium	Details regarding this metric were omitted; the lack of information made this study difficult to interpret.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	General information on species sampled and their source was provided.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	Low	Biomagnification methodology was not reported; data were only provided in supplemental information.	3	1	3

	12. Sampling Methods	Low	Details regarding this metric were omitted; the lack of information made this study difficult to interpret.	3	1	3
Confounding / Variable Control	13. Confounding Variables	Not rated	Not able to evaluate given the lack of information provided in the study.	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Low	Biomagnification factor values appeared to be in the supplemental report, which was not readily available; the lack of information decreased the value of the information and made this study difficult to interpret. Biomagnification factors results for HBCD were only described generally in the publication.	3	2	6
	16. Statistical Methods and Kinetic Calculations	Not rated	Not able to evaluate given the lack of information provided in the study.	NR	NR	NR
Other	17. Verification or Plausibility of Results	Low	The conclusion briefly discussed individual isomer behavior; however, no data were provided (data were given for the sum of isomers; analytical methods suggesting resolution were not provided).	3	1	3
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	28	15	36
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	2.4	**Overall Score (Rounded):**	2.4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Low[1]
[1]Biomagnification was not reported but may be available in a supplemental report.						

Study Reference:	Sun, YX; Luo, XJ; Mo, L; He, MJ; Zhang, Q; Chen, SJ; Zou, FS; Mai, BX. (2012). Hexabromocyclododecane in terrestrial passerine birds from e-waste, urban and rural locations in the Pearl River Delta, South China: levels, biomagnification, diastereoisomer- and enantiomer-specific accumulation. Environ Pollut 171: 191-198. http://dx.doi.org/10.1016/j.envpol.2012.07.026. HERO ID: 1927580					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Source and purity (commercial grade) were reported.	1	1	1
Test Design	3. Study Controls	High	Site chosen for measurement of background levels; trace amounts of alpha-HBCD noted in procedural blanks and samples corrected accordingly	1	2	2
	4. Test Substance Stability	High	The test substance stability, sample homogenization, preparation and storage were appropriate for the study and were described in the report.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	Test conditions were reported in detail and were appropriate for the study. As this was a field sampling study rather than a test with laboratory organisms, conditions such as pH and DO were not measured or necessary.	1	2	2
	7. Testing Consistency	High	Test conditions were consistent across bird species and samples. Exposure conditions were documented.	1	1	1
	8. System Type and Design	High	Test system and design were appropriate for this study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR

	10. Test Organism Partitioning	Medium	Only one trophic level was examined. Details regarding feeding and life history of bird samples were provided in supplemental information.	2	2	4
Outcome Assessment	11. Outcome Assessment Methodology	High	The isomer was not found in the species monitored and therefore an assessment of biomagnification factor could not be done.	1	1	1
	12. Sampling Methods	High	Details of sample collection were provided in a referenced publication. Sample locations were adequately described, as was tissue processing. Methods used were widely accepted.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Study evaluated potential sources of uncertainty and variability. No confounding variables were noted for beta-HBCD.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study. Lipid- normalized concentrations were reported for each isomer.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	Statistical methods were clearly described and were adequate for the dataset.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	20	22

High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.1	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Sun, YX; Luo, XJ; Mo, L; He, MJ; Zhang, Q; Chen, SJ; Zou, FS; Mai, BX. (2012). Hexabromocyclododecane in terrestrial passerine birds from e-waste, urban and rural locations in the Pearl River Delta, South China: levels, biomagnification, diastereoisomer- and enantiomer-specific accumulation. Environ Pollut 171: 191-198. http://dx.doi.org/10.1016/j.envpol.2012.07.026. HERO ID: 1927580					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Source and purity (commercial grade) were reported.	1	1	1
Test Design	3. Study Controls	High	Site chosen for measurement of background levels; trace amounts of alpha-HBCD noted in procedural blanks and samples corrected accordingly.	1	2	2
	4. Test Substance Stability	High	The test substance stability, sample homogenization, preparation and storage were appropriate for the study and were described in the report.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	Test conditions were reported in detail and were appropriate for the study. As this was a field sampling study rather than a test with laboratory organisms, conditions such as pH and DO were not measured or necessary.	1	2	2
	7. Testing Consistency	High	Test conditions were consistent across bird species and samples. Exposure conditions were documented.	1	1	1
	8. System Type and Design	High	Test system and design were appropriate for this study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR

	10. Test Organism Partitioning	Medium	Only one trophic level was sampled. Details regarding feeding and life history of birds sampled were provided in supplemental information.	2	2	4
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment methodology clearly reported the intended outcome of the study.	1	1	1
	12. Sampling Methods	High	Details of sample collection were provided in a referenced publication. Sample locations were adequately described, as was tissue processing. Methods used were widely accepted.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty were evaluated and discussed in the study. Average recovery of alpha-HBCD in the spiked blank was 96.4%; no confounding variables were noted.	1	1	1
Data Presentation and Analysis	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study. Lipid- normalized concentrations were reported for each isomer, as well as lipid-adjusted biomagnification factors.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	Statistical methods were clearly described and were adequate for the dataset.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	20	22
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.1	**Overall Score (Rounded):**	1.1

≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Sun, YX; Luo, XJ; Mo, L; He, MJ; Zhang, Q; Chen, SJ; Zou, FS; Mai, BX. (2012). Hexabromocyclododecane in terrestrial passerine birds from e-waste, urban and rural locations in the Pearl River Delta, South China: levels, biomagnification, diastereoisomer- and enantiomer-specific accumulation. Environ Pollut 171: 191-198. http://dx.doi.org/10.1016/j.envpol.2012.07.026. HERO ID: 1927580					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Source and purity (commercial grade) were reported.	1	1	1
Test Design	3. Study Controls	High	Site chosen for measurement of background levels; trace amounts of alpha-HBCD were noted in procedural blanks and samples were corrected accordingly.	1	2	2
	4. Test Substance Stability	High	The test substance stability, sample homogenization, preparation and storage were appropriate for the study and were described in the report.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	Test conditions were reported in detail and were appropriate for the study. As this was a field sampling study rather than a test with laboratory organisms, conditions such as pH and DO were not measured or necessary.	1	2	2
	7. Testing Consistency	High	Test conditions were consistent across bird species and samples. Exposure conditions were documented.	1	1	1
	8. System Type and Design	High	Test system and design were appropriate for this study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR

	10. Test Organism Partitioning	Medium	Only one trophic level was sampled. Details regarding feeding and life history of bird samples were provided in supplemental information.	2	2	4
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment methodology clearly reported the intended outcome of the study.	1	1	1
	12. Sampling Methods	High	Details of sample collection were provided in a referenced publication. Sample locations were adequately described, as was tissue processing. Methods used were widely accepted.	1	1	1
Confounding / Variable Control	13. Confounding Variables	Low	Limitations were noted about the calculation that led to uncertainties on the biomagnification factor results for the gamma isomer (it was not calculated using 1-to-1 correspondence between bird tissue and stomach contents). This may have limited the usefulness of this value.	3	1	3
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study. Lipid- normalized concentrations were reported for each isomer, as well as lipid-adjusted biomagnification factors.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	Statistical methods were clearly described and were adequate for the dataset.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	18	20	24
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.2	**Overall Score (Rounded):**	1.2

≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Fournier, A; Feidt, C; Marchand, P; Vénisseau, A; Le Bizec, B; Sellier, N; Engel, E; Ratel, J; Travel, A; Jondreville, C. (2012). Kinetic study of γ-hexabromocyclododecane orally given to laying hens (Gallus domesticus). "Transfer of HBCD in laying hens". Environ Sci Pollut Res Int 19: 440-447. http://dx.doi.org/10.1007/s11356-011-0573-6. HERO ID: 1927629					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source was reported.	1	1	1
Test Design	3. Study Controls	High	Control organisms were included, and analytical blanks were run and used for correction.	1	2	2
	4. Test Substance Stability	High	Adequate storage of tissue samples; internal and external standards were reported.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	Medium	Some details were omitted; however, this was not likely to have had a substantial impact on the results.	2	2	4
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	High	Test system was described and appropriate for the experiment.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Non-routine with adequate description. Species, age, sex, and body weight were reported.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	Outcome assessment methodology addressed the intended outcomes of interest.	1	1	1

	12. Sampling Methods	High	Sampling methods addressed outcomes of interest, were widely accepted, and were appropriate for the analyses.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	No confounding variables were identified.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Data reporting was thorough and detailed. BCFs were lipid normalized.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	20	22
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.1	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	He, MJ; Luo, XJ; Yu, LH; Liu, J; Zhang, XL; Chen, SJ; Chen, D; Mai, BX. (2010). Tetrabromobisphenol-A and hexabromocyclododecane in birds from an e-waste region in South China: influence of diet on diastereoisomer- and enantiomer-specific distribution and trophodynamics. Environ Sci Technol 44: 5748-5754. http://dx.doi.org/10.1021/es101503r. HERO ID: 1927673					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means. The source of the analytical standard was reported.	1	1	1
Test Design	3. Study Controls	Medium	Trace HBCDs found in procedural blanks were not subtracted.	2	2	4
	4. Test Substance Stability	Medium	The test substance stability, homogeneity, preparation and storage conditions were not reported; however, these factors were not likely to have influenced the test substance or were not likely to have had a substantial impact on study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	Medium	Detailed information on species and site was cited, although limited detail on environmental sampling parameters was provided. However, these omissions were not likely to have had a substantial impact on study results.	2	2	4

	7. Testing Consistency	High	Conditions of exposure were documented. Birds collected were found dead or dying from various causes; however, given that the intent of the study was to determine chemical concentrations in bird species regardless of exposure method, this should not have impacted the study results.	1	1	1
	8. System Type and Design	High	Field study; system type and design were considered appropriate.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Details on each species were cited in supporting information; field study investigated concentrations in species of different trophic levels.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	Medium	Limited details were provided on the derivation of the biomagnification factor values.	2	1	2
	12. Sampling Methods	High	No sampling limitations were noted that would have influenced the study results.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	No confounding variables were identified; sources of variability and uncertainty were accounted for in data evaluation and presentation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Data Presentation and Analysis	15. Data Reporting	Low	Some details were omitted; extra detail in supporting information; however, critical parameters such as injection temperature for speciation were not reported; this limited the validity of the results.	3	2	6
	16. Statistical Methods and Kinetic Calculations	Medium	Limited data were provided regarding this metric; however, this was not likely to have hindered the interpretation of the results.	2	1	2
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	22	20	31
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.55	**Overall Score (Rounded):**	1.6
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	He, MJ; Luo, XJ; Yu, LH; Liu, J; Zhang, XL; Chen, SJ; Chen, D; Mai, BX. (2010). Tetrabromobisphenol-A and hexabromocyclododecane in birds from an e-waste region in South China: influence of diet on diastereoisomer- and enantiomer-specific distribution and trophodynamics. Environ Sci Technol 44: 5748-5754. http://dx.doi.org/10.1021/es101503r. HERO ID: 1927673					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means. The source of the analytical standard was reported.	1	1	1
Test Design	3. Study Controls	Medium	Trace HBCDs found in procedural blanks were not subtracted.	2	2	4
	4. Test Substance Stability	Medium	The test substance stability, homogeneity, preparation and storage conditions were not reported; however, these factors were not likely to have influenced the test substance or were not likely to have had a substantial impact on the study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	Medium	Detailed information on species and site was cited, although limited detail on environmental sampling parameters was provided. However, these omissions were not likely to have had a substantial impact on the study results.	2	2	4

	7. Testing Consistency	High	Conditions of exposure were documented. Birds collected were found dead or dying from various causes; however, given that the intent of the study was to determine chemical concentrations in bird species regardless of exposure method, this should not have impacted the study results.	1	1	1
	8. System Type and Design	High	Field study; system type and design were considered appropriate.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Details on each species were cited in supporting information; field study investigated concentrations in species of different trophic levels.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	Medium	Limited details were provided on the derivation of the biomagnification factor values.	2	1	2
	12. Sampling Methods	High	No sampling limitations were noted that would have influenced the study results.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	No confounding variables were identified; sources of variability and uncertainty were accounted for in data evaluation and presentation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Data Presentation and Analysis	15. Data Reporting	Low	Some details were omitted; extra detail in supporting information; however, critical parameters such as injection temperature for speciation was not reported. This limited the validity of the results.	3	2	6
	16. Statistical Methods and Kinetic Calculations	Medium	Limited data were provided regarding this metric; however, this was not likely to have hindered the interpretation of the results.	2	1	2
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	22	20	31
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.55	**Overall Score (Rounded):**	1.6
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Janák, K; Sellström, U; Johansson, AK; Becher, G; de Wit, CA; Lindberg, P; Helander, B. (2008). Enantiomer-specific accumulation of hexabromocyclododecanes in eggs of predatory birds. Chemosphere 73: S193-S200. http://dx.doi.org/10.1016/j.chemosphere.2007.03.077. HERO ID: 1927746					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source was reported.	1	1	1
Test Design	3. Study Controls	Medium	Analytical controls were included; however, results were not provided.	2	2	4
	4. Test Substance Stability	Low	The sample stability and storage conditions were not reported, and these factors likely influenced the test substance or were likely to have had a substantial impact on the study results.	3	1	3
Test Conditions	5. Test Method Suitability	Not rated	The metric is not applicable to this study type (monitoring).	NR	NR	NR
	6. Testing Conditions	Medium	Monitoring of various species within a defined area; details of ambient environment not included.	2	2	4
	7. Testing Consistency	Medium	All samples except the herring (prey) were measured in triplicate.	2	1	2
	8. System Type and Design	Not rated	The metric is not applicable to this study type (monitoring).	NR	NR	NR
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Monitoring of various species within a defined area.	1	2	2

Outcome Assessment	11. Outcome Assessment Methodology	Unacceptable	Limitations in the analytical methods were reported. Samples were analyzed in a previous report; storage and stability of the samples were not reported or confirmed; additional internal standard added to 'old' samples making the analysis semi-quantitative; 'good quantification' was only noted for herring samples and not achieved with bird samples. The limitations identified in the analytical process were likely to have had a substantial impact on the results, resulting in serious flaws that made the study unreliable.	4	1	4
	12. Sampling Methods	Unacceptable	Samples were collected at various times in multiple monitoring efforts previously reported; storage and handling of the samples were not reported; stability of the sample integrity was not reported or confirmed.	4	1	4
Confounding / Variable Control	13. Confounding Variables	Low	There is concern that variability or uncertainty was likely to have had a substantial impact on the results.	3	1	3
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	This study was primarily a monitoring study. Some details were omitted.	2	2	4

	16. Statistical Methods and Kinetic Calculations	Not rated	Statistical analysis or kinetic calculations were not applicable to this study type.	NR	NR	NR
Other	17. Verification or Plausibility of Results	Medium	Authors discussed results as semi- quantitative and made generalizations comparable to other studies.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	27	17	35
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	2.06	**Overall Score (Rounded):**	4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Unacceptable[1]

[1]There were limitations in the analytical methods reported and sample concerns. Samples were collected at various times in multiple monitoring efforts previously reported and storage and handling of the samples were not reported. In addition, stability of the sample integrity was not reported or confirmed. Consistent with our Application of Systematic Review in TSCA Risk Evaluations document, if a metric for a data source receives a score of Unacceptable (score = 4), EPA will determine the study to be unacceptable. In this case, two of the metrics were rated as unacceptable. As such, the study is considered unacceptable and the score is presented solely to increase transparency.

Study Reference:	Sørmo, EG; Salmer, MP; Jenssen, BM; Hop, H; Baek, K; Kovacs, KM; Lydersen, C; Falk-Petersen, S; Gabrielsen, GW; Lie, E; Skaare, JU. (2006). Biomagnification of polybrominated diphenyl ether and hexabromocyclododecane flame retardants in the polar bear food chain in Svalbard, Norway. Environ Toxicol Chem 25: 2502-2511. http://dx.doi.org/10.1897/05-591R.1. HERO ID: 1927787					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	The test substance was identified by analytical means. The analytical standard source and purity were not reported.	2	1	2
Test Design	3. Study Controls	High	Analytical controls were included in the study.	1	2	2
	4. Test Substance Stability	High	The test substance stability was accounted for and appropriate for the study.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	Testing conditions were monitored, reported, and appropriate for the method.	1	2	2
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	High	Test system was described and appropriate for the experiment.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Medium	Trophic levels were not confirmed by analytical means; however, this was not likely to have hindered the interpretation of the results.	2	2	4
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study.	1	1	1
	12. Sampling Methods	High	Sampling was reported and appropriate.	1	1	1

Confounding / Variable Control	13. Confounding Variables	High	No confounding variables were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Biomagnification factor was reported.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	The analysis of data was clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	17	20	23
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.15	**Overall Score (Rounded):**	1.2
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Li, B; Yao, T; Sun, H; Zhang, Y; Yang, J. (2016). Diastereomer- and enantiomer-specific accumulation, depuration, bioisomerization, and metabolism of hexabromocyclododecanes (HBCDs) in two ecologically different species of earthworms. Sci Total Environ 542: 427-434. http://dx.doi.org/10.1016/j.scitotenv.2015.10.100. HERO ID: 3350510					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source and purity were reported.	1	1	1
Test Design	3. Study Controls	High	Blank controls were used with no HBCD added.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	Testing conditions were reported and appropriate for the method.	1	2	2
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Test organism information was reported.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study.	1	1	1
	12. Sampling Methods	High	Sampling was reported and appropriate.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	No confounding variables were noted.	1	1	1

	14. Outcomes Unrelated to Exposure	High	No attrition or health differences in organisms were reported.	1	1	1
Data Presentation and Analysis	15. Data Reporting	High	Depuration rate constants were reported.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	Statistical methods and calculations were clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	15	20	20
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1	**Overall Score (Rounded):**	1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Zhu, C; Wang, P; Li, Y; Chen, Z; Li, H; Ssebugere, P; Zhang, Q; Jiang, G. (2017). Trophic transfer of hexabromocyclododecane in the terrestrial and aquatic food webs from an e- waste dismantling region in East China. Environ Sci Process Impacts 19: 154-160. http://dx.doi.org/10.1039/c6em00617e. HERO ID: 3546047					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	The test substance was identified by analytical means. The purity of the analytical standards was not reported.	2	1	2
Test Design	3. Study Controls	High	Analytical controls were included in the study.	1	2	2
	4. Test Substance Stability	High	The test substance stability was accounted for and appropriate for the study.	1	1	1
Test Conditions	5. Test Method Suitability	High	Extraction and analytical methods were appropriate.	1	1	1
	6. Testing Conditions	High	Testing conditions were appropriate for the method.	1	2	2
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	Not rated	The metric is not applicable to this study type (monitoring data).	NR	NR	NR
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Monitoring of various species within a defined area.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study.	1	1	1
	12. Sampling Methods	High	Sampling was reported and appropriate.	1	1	1
Confounding / Variable Control	13. Confounding Variables	Low	All results were considered statically insignificant due in part to the limited number of species.	3	1	3

	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Terrestrial trophic magnification factor was reported.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	The analysis of data was clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	Low	Practical comparison with other studies of this type is impossible as the results were considered not statically significant.	3	1	3
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	19	19	24
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.26	**Overall Score (Rounded):**	1.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	U.S. EPA (U.S. Environmental Protection Agency). (2017). IUCLID data set: hexbromocyclododecane. Retrieved from https://java.epa.gov/oppt_chemical_search/. HERO ID: 3970216					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	Composite of 3 commercial grade HBCD lots; unlikely to have had impurities that affected study results.	2	1	2
Test Design	3. Study Controls	High	Blank controls were used with no HBCD added.	1	2	2
	4. Test Substance Stability	Medium	The test substance preparation and storage were not reported but unlikely to have influenced study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	Some testing parameters such as temperature, TOC, and lipid content were not reported but likely did not impact the study results substantially.	1	2	2
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Medium	Test organism was reported but some characteristics were not reported.	2	2	4
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study.	1	1	1

	12. Sampling Methods	Medium	Sampling was not described in detail, but this was unlikely to have impacted the study results substantially.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	No confounding variables were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	High	No differences in organism attrition or health outcomes between study groups were noted.	1	1	1
Data Presentation and Analysis	15. Data Reporting	Medium	Lipid content not reported; however, its omission was not likely to have impacted the study results.	2	2	4
	16. Statistical Methods and Kinetic Calculations	High	Statistical method for calculating BCF was reported. Kinetic calculations were not reported.	1	1	1
Other	17. Verification or Plausibility of Results	Medium	This metric met the criteria for high confidence as expected for this type of study.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	21	20	28
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.4	**Overall Score (Rounded):**	1.4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	U.S. EPA (U.S. Environmental Protection Agency). (2002). EPA HPV Track: 1,2,5,6,9,10-Hexabromocyclododecane. https://java.epa.gov/oppt_chemical_search/. HERO ID: 3970217					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source and purity were reported.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Medium	Details were omitted; however, the omissions were unlikely to have hindered interpretation of results.	2	1	2
Confounding / Variable Control	13. Confounding Variables	Not rated	No confounding variables were noted.	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	15	19	20
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.05	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Wu, JP; Guan, YT; Zhang, Y; Luo, XJ; Zhi, H; Chen, SJ; Mai, BX. (2011). Several current-use, non-PBDE brominated flame retardants are highly bioaccumulative: evidence from field determined bioaccumulation factors. Environ Int 37: 210-215. http://dx.doi.org/10.1016/j.envint.2010.09.006. HERO ID: 1443814					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	The test substance was identified by analytical means. The source and purity of the analytical reference materials were not provided.	2	1	2
Test Design	3. Study Controls	Medium	Analytical controls/blanks were not reported.	2	2	4
	4. Test Substance Stability	Low	Samples were prepared in a previous study cited; reference date was 2 years prior to the publish date; storage and stability of samples were not reported.	3	1	3
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	Medium	Field study; limited information on the site.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR

	10. Test Organism Partitioning	Medium	Details on each species were not included; field study investigated concentrations in aquatic species of different trophic levels; trophic level determination referenced to previous study.	2	2	4
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	Not rated	No confounding variables were noted.	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Concentrations employed in the BAF calculations were not provided; however, the data were referenced to the primary source.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Medium	Statistical analysis of the results was indicated; however, data relating to the specific results were not provided.	2	1	2
Other	17. Verification or Plausibility of Results	High	Comparable to other studies with reasonable discrepancies noted.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	22	19	30
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.58	**Overall Score (Rounded):**	1.6
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Wu, JP; Guan, YT; Zhang, Y; Luo, XJ; Zhi, H; Chen, SJ; Mai, BX. (2011). Several current-use, non-PBDE brominated flame retardants are highly bioaccumulative: evidence from field determined bioaccumulation factors. Environ Int 37: 210-215. http://dx.doi.org/10.1016/j.envint.2010.09.006. HERO ID: 1443814					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	The test substance was identified by analytical means. The source and purity of the analytical reference materials were not provided.	2	1	2
Test Design	3. Study Controls	Medium	Analytical controls/blanks were not reported.	2	2	4
	4. Test Substance Stability	Low	Samples were prepared in a previous study cited; reference date was 2 years prior to the publish date; storage and stability of samples were not reported.	3	1	3
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	Medium	Field study; limited information on the site.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR

	10. Test Organism Partitioning	Medium	Details on each species were not included; field study investigated concentrations in aquatic species of different trophic levels; trophic level determination referenced to previous study.	2	2	4
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study; log BAF values were reported.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	Not rated	No confounding variables were noted.	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Concentrations employed in the BAF calculations were not provided; however, the data were referenced to the primary source.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Medium	Statistical analysis of the results was indicated; however, data relating to the specific results were not provided.	2	1	2
Other	17. Verification or Plausibility of Results	High	Comparable to other studies with reasonable discrepancies noted.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	22	19	30
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.58	**Overall Score (Rounded):**	1.6
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	**Wu, JP; Guan, YT; Zhang, Y; Luo, XJ; Zhi, H; Chen, SJ; Mai, BX. (2011). Several current-use, non-PBDE brominated flame retardants are highly bioaccumulative: evidence from field determined bioaccumulation factors. Environ Int 37: 210-215. http://dx.doi.org/10.1016/j.envint.2010.09.006.** **HERO ID: 1443814**

Domain	Metric	Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]	Comments	Metric Score	Metric Weighting Factor	Weighted Score
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	The test substance was identified by analytical means. The source and purity of the analytical reference materials were not provided.	2	1	2
Test Design	3. Study Controls	Medium	Analytical controls/blanks were not reported.	2	2	4
	4. Test Substance Stability	Low	Samples were prepared in a previous study cited; reference date was 2 years prior to the publish date; storage and stability of samples were not reported.	3	1	3
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	Medium	Field study; limited information on the site.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Medium	Details on each species were not included; field study investigated concentrations in aquatic species of different trophic levels; trophic level determination referenced to previous study.	2	2	4
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study; log BAF values were reported.	1	1	1

	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	Not rated	No confounding variables were noted.	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Concentrations employed in the BAF calculations were not provided; however, the data were referenced to the primary source.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Medium	Statistical analysis of the results was indicated; however, data relating to the specific results were not provided.	2	1	2
Other	17. Verification or Plausibility of Results	High	Comparable to other studies with reasonable discrepancies noted.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	22	19	30
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.58	**Overall Score (Rounded):**	1.6
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Ismail, N; Gewurtz, SB; Pleskach, K; Whittle, DM; Helm, PA; Marvin, CH; Tomy, GT. (2009). Brominated and chlorinated flame retardants in Lake Ontario, Canada, lake trout (Salvelinus namaycush) between 1979 and 2004 and possible influences of food- web changes. Environ Toxicol Chem 28: 910-920. http://dx.doi.org/10.1897/08-162.1. HERO ID: 1443833					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Source and purity were reported.	1	1	1
Test Design	3. Study Controls	High	Quality controls were included; HBCD was not detected in the blanks.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	Medium	Storage conditions were not verified over long periods of time; this may have hindered the precise interpretation of the results.	2	1	2
	6. Testing Conditions	High	Field study; Great Lakes Laboratory for Fisheries and Aquatic Sciences long-term monitoring study.	1	2	2
	7. Testing Consistency	Medium	Test conditions were consistent across samples or study groups.	2	1	2
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2

Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Medium	This metric met the criteria for high confidence as expected for this type of study.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Some data were referenced to supporting information tables that were not readily available.	2	2	4
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	19	20	25
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.25	**Overall Score (Rounded):**	1.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Ismail, N; Gewurtz, SB; Pleskach, K; Whittle, DM; Helm, PA; Marvin, CH; Tomy, GT. (2009). Brominated and chlorinated flame retardants in Lake Ontario, Canada, lake trout (Salvelinus namaycush) between 1979 and 2004 and possible influences of food- web changes. Environ Toxicol Chem 28: 910-920. http://dx.doi.org/10.1897/08-162.1. HERO ID: 1443833					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Source and purity were reported.	1	1	1
Test Design	3. Study Controls	High	Quality controls were included; HBCD was not detected in the blanks.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	Medium	Storage conditions were not verified over long periods of time; this may have hindered the precise interpretation of the results.	2	1	2
	6. Testing Conditions	High	Field study; Great Lakes Laboratory for Fisheries and Aquatic Sciences long-term monitoring study.	1	2	2
	7. Testing Consistency	Medium	Test conditions were consistent across samples or study groups.	2	1	2
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2

Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Medium	This metric met the criteria for high confidence as expected for this type of study.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Some data were referenced to supporting information tables that were not readily available.	2	2	4
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	19	20	25
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.25	**Overall Score (Rounded):**	1.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Ismail, N; Gewurtz, SB; Pleskach, K; Whittle, DM; Helm, PA; Marvin, CH; Tomy, GT. (2009). Brominated and chlorinated flame retardants in Lake Ontario, Canada, lake trout (Salvelinus namaycush) between 1979 and 2004 and possible influences of food- web changes. Environ Toxicol Chem 28: 910-920. http://dx.doi.org/10.1897/08-162.1. HERO ID: 1443833					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Source and purity were reported.	1	1	1
Test Design	3. Study Controls	High	Quality controls were included; HBCD was not detected in the blanks.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	Medium	Storage conditions were not verified over long periods of time; this may have hindered the precise interpretation of the results.	2	1	2
	6. Testing Conditions	High	Field study; Great Lakes Laboratory for Fisheries and Aquatic Sciences long-term monitoring study.	1	2	2
	7. Testing Consistency	Medium	Test conditions were consistent across samples or study groups.	2	1	2
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2

Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Medium	This metric met the criteria for high confidence as expected for this type of study.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Some data were referenced to supporting information tables that were not readily available.	2	2	4
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	19	20	25
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.25	**Overall Score (Rounded):**	1.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Tomy, GT; Pleskach, K; Oswald, T; Halldorson, T; Helm, PA; Macinnis, G; Marvin, CH. (2008). Enantioselective bioaccumulation of hexabromocyclododecane and congener- specific accumulation of brominated diphenyl ethers in an eastern Canadian Arctic marine food web. Environ Sci Technol 42: 3634-3639. http://dx.doi.org/10.1021/es703083z. HERO ID: 1443836					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Source and purity were reported.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	Medium	There were some conditions of the local environment that were not reported/assessed; however, the lack of data on the field conditions was not likely to have had a substantial impact on the study results.	2	2	4
	7. Testing Consistency	High	Test conditions were consistent across samples or study groups.	1	1	1
	8. System Type and Design	Medium	Field study; equilibrium was not confirmed or reported; the deviation may have limited strict interpretation of the study results.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Test organism information was reported. The test organism was routinely used for similar study types.	1	2	2

Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Low	The samples of the top feeders were taken before the bottom feeders; this may have been a flaw in examining the true BMF/TMF.	3	1	3
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	Medium	Well done study with clear data reporting; however, the sampling dates may be a minor concern.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	20	20	26
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.3	**Overall Score (Rounded):**	1.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Law, K; Palace, VP; Halldorson, T; Danell, R; Wautier, K; Evans, B; Alaee, M; Marvin, C; Tomy, GT. (2006). Dietary accumulation of hexabromocyclododecane diastereoisomers in juvenile rainbow trout (Oncorhynchus mykiss). I: Bioaccumulation parameters and evidence of bioisomerization. Environ Toxicol Chem 25: 1757. http://dx.doi.org/10.1897/05-445r.1. HERO ID: 1443861					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Source and purity were reported.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	Test conditions were consistent across samples or study groups.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Test organism information was reported. The test organism was routinely used for similar study types.	1	2	2

Outcome Assessment	11. Outcome Assessment Methodology	Medium	Some details regarding the extraction and analytical methods were not reported; however, the methods were referenced to the primary source.	2	1	2
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	20	21
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.05	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	ACC (American Chemistry Council). (2005). HPV data summary and test plan for hexabromocyclododecane (HBCD). Arlington, VA: Brominated Flame Retardant Industry Panel (BFRIP), American Chemistry Council. http://www.epa.gov/oppt/chemrtk/pubs/summaries/cyclodod/c13459tc.htm. HERO ID: 1443881					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Source was reported.	1	1	1
Test Design	3. Study Controls	Low	Details regarding this metric were omitted; however, this source is a robust summary and a routine OECD guideline was cited.	3	2	6
	4. Test Substance Stability	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	2	4
	7. Testing Consistency	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
	8. System Type and Design	Medium	Details regarding this metric were omitted; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR

	10. Test Organism Partitioning	High	Routine species but details were not provided; however, this source is a robust summary and a routine OECD guideline was cited.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
	12. Sampling Methods	Low	Details regarding this metric were omitted; however, this source is a robust summary and a routine OECD guideline was cited.	3	1	3
Confounding / Variable Control	13. Confounding Variables	Medium	An issue with steady state was noted.	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
Other	17. Verification or Plausibility of Results	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	28	20	37
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.85	**Overall Score (Rounded):**	1.6
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High[1]

[1]This study's overall quality rating was upgraded: This is a secondary source; however, it is a robust summary and a routine OECD guideline was cited and primary reference may provide validation; Drottar K. and Krueger H. 2000. Hexabromocyclododecane (HBCD): Flow-through bioconcentration test with rainbow trout (Oncorhynchus mykiss). Project No.: 439A-111. Wildlife International, Ltd. Easton, MD.

Study Reference:	He, MJ; Luo, XJ; Yu, LH; Wu, JP; Chen, SJ; Mai, BX. (2013). Diasteroisomer and enantiomer- specific profiles of hexabromocyclododecane and tetrabromobisphenol A in an aquatic environment in a highly industrialized area, South China: vertical profile, phase partition, and bioaccumulation. Environ Pollut 179: 105-110. http://dx.doi.org/10.1016/j.envpol.2013.04.016. HERO ID: 1927551					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Low	Source and purity were not reported.	3	1	3
Test Design	3. Study Controls	Low	Controls were not reported.	3	2	6
	4. Test Substance Stability	Medium	Details regarding this metric were omitted; however, this was not likely to have hindered the interpretation of the results.	2	1	2
Test Conditions	5. Test Method Suitability	High	Test method was appropriate and described in a previously published study by the same authors.	1	1	1
	6. Testing Conditions	High	Test conditions (temperature, organic matter) were measured and reported.	1	2	2
	7. Testing Consistency	High	Test conditions were consistent across samples; no inconsistencies were reported.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Details on each species were not included; field study investigated concentrations in aquatic species of different trophic levels. Referenced previous study by same authors.	1	2	2

Outcome Assessment	11. Outcome Assessment Methodology	Medium	Log BAF values were reported as a range; limited details were provided on the calculations. However, the absence of these details was unlikely to have had a substantial impact on the study results.	2	1	2
	12. Sampling Methods	High	Samples were collected using widely accepted methods/approaches; additional details were referenced to previous study by same authors.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation. No confounding variables were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Log BAF values were reported (as a range and not specific to the isomer aside from mentioning the alpha had the greatest value). Concentrations were lipid normalized.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	The analysis of data was clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	Medium	Study results were reasonable and compared to other studies.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	22	20	29
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.45	**Overall Score (Rounded):**	1.5
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	La Guardia, MJ; Hale, RC; Harvey, E; Mainor, TM; Ciparis, S. (2012). In situ accumulation of HBCD, PBDEs, and several alternative flame-retardants in the bivalve (Corbicula fluminea) and gastropod (Elimia proxima). Environ Sci Technol 46: 5798-5805. http://dx.doi.org/10.1021/es3004238. HERO ID: 1927601					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means. Source and purity of surrogate standards added to each sample prior to extraction were reported.	1	1	1
Test Design	3. Study Controls	High	The method blank did not contain any HBCD above detection limits.	1	2	2
	4. Test Substance Stability	High	The test substance stability, homogeneity, preparation, and storage conditions were adequately described in the paper and supporting information.	1	1	1
Test Conditions	5. Test Method Suitability	High	Test method was reported and considered suitable for the test material.	1	1	1
	6. Testing Conditions	High	Test conditions, including temperature and organic matter, were reported and appropriate.	1	2	2
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Organism sampling locations were described. Details on species were not included; field study investigated concentrations in aquatic species at different trophic levels.	1	2	2

Outcome Assessment	11. Outcome Assessment Methodology	Medium	Incomplete reporting of outcome assessment methods, although not likely to have had a substantial impact on study results. Recovery of C- labeled HBCD ranged from 61 to 108%.	2	1	2
	12. Sampling Methods	High	Sampling time and frequency were appropriate for the study; analytical methods were considered acceptable.	1	1	1
Confounding / Variable Control	13. Confounding Variables	Not rated	No confounding variables were noted.	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Some details were limited; tables could have provided better insight on actual BAF and BASF values; additional yet limited information was in supporting file.	2	2	4
	16. Statistical Methods and Kinetic Calculations	High	Details were limited; additional yet limited information was in supporting file.	1	1	1
Other	17. Verification or Plausibility of Results	Medium	Some details were limited; additional yet limited information was in supporting file.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	17	19	23
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.21	**Overall Score (Rounded):**	1.2
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Haukås, M; Hylland, K; Nygård, T; Berge, JA; Mariussen, E. (2010). Diastereomer-specific bioaccumulation of hexabromocyclododecane (HBCD) in a coastal food web, Western Norway. Sci Total Environ 408: 5910-5916. http://dx.doi.org/10.1016/j.scitotenv.2010.08.026. HERO ID: 1927667					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Low	The test substance was identified by analytical means. The source and purity of the reference substances were not reported or verified by analytical means.	3	1	3
Test Design	3. Study Controls	Medium	The study did not require concurrent control groups; analytical controls were not reported.	2	2	4
	4. Test Substance Stability	Medium	Data regarding this metric were omitted; however, these omissions were not likely to have influenced the study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	Not reported in detail, but not likely to have influenced the study results.	1	2	2
	7. Testing Consistency	High	Test conditions were consistent across species.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Appropriate trophic level analysis. Field study investigated concentrations in aquatic species of different trophic levels.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

	12. Sampling Methods	High	Study used widely accepted sampling methods, which were applicable for the chemical and media being analyzed.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Potential confounding variables and sources of uncertainty were reported and discussed in the study and were not likely to have had an impact on the study results and interpretation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Low	Limited information on analytical methods; extraction efficiency, injection temperatures and percent recovery were not measured/reported.	3	2	6
	16. Statistical Methods and Kinetic Calculations	High	Statistical methods were clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	21	20	29
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.45	**Overall Score (Rounded):**	1.5
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Wu, JP; Guan, YT; Zhang, Y; Luo, XJ; Zhi, H; Chen, SJ; Mai, BX. (2010). Trophodynamics of hexabromocyclododecanes and several other non-PBDE brominated flame retardants in a freshwater food web. Environ Sci Technol 44: 5490-5495. http://dx.doi.org/10.1021/es101300t. HERO ID: 1927678					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Source was reported.	1	1	1
Test Design	3. Study Controls	Medium	The study did not require concurrent control groups; analytical blanks were included.	2	2	4
	4. Test Substance Stability	Low	Samples were prepared in a previous study cited; reference date was 2 years prior to the publish date; storage and stability of samples were not reported.	3	1	3
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Additional information in supporting information.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

	12. Sampling Methods	Medium	Limited detail was provided; however, this did not hinder the interpretation of the results.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Limited data; additional data with supporting document; injection temperature of analytical method was not specified for isomeric resolution.	2	2	4
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	20	20	27
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.35	**Overall Score (Rounded):**	1.4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High[1]
[1]It is noted that information in Table 1 was used to calculate lipid normalized BAF's.						

Study Reference:	**Wu, JP; Guan, YT; Zhang, Y; Luo, XJ; Zhi, H; Chen, SJ; Mai, BX. (2010). Trophodynamics of hexabromocyclododecanes and several other non-PBDE brominated flame retardants in a freshwater food web. Environ Sci Technol 44: 5490-5495. http://dx.doi.org/10.1021/es101300t.** **HERO ID: 1927678**

Domain	Metric	Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]	Comments	Metric Score	Metric Weighting Factor	Weighted Score
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2

	2. Test Substance Purity	High	Source was reported.	1	1	1
Test Design	3. Study Controls	High	The study did not require concurrent control groups; analytical blanks were included.	1	2	2
	4. Test Substance Stability	Low	Samples were prepared in a previous study cited; reference date was 2 years prior to the publish date; storage and stability of samples were not reported.	3	1	3
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Additional information in supporting information.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Medium	Limited detail was provided; however, this did not hinder the interpretation of the results.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Data Presentation and Analysis	15. Data Reporting	Medium	Limited data; additional data with supporting document; injection temperature of analytical method was not specified for isomeric resolution.	2	2	4
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	19	20	25
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.25	**Overall Score (Rounded):**	1.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High[1]
[1]It is noted that information in Table 1 was used to calculate lipid normalized BAF's.						
Study Reference:	**Wu, JP; Guan, YT; Zhang, Y; Luo, XJ; Zhi, H; Chen, SJ; Mai, BX. (2010). Trophodynamics of hexabromocyclododecanes and several other non-PBDE brominated flame retardants in a freshwater food web. Environ Sci Technol 44: 5490-5495. http://dx.doi.org/10.1021/es101300t. HERO ID: 1927678**					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Source was reported.	1	1	1
Test Design	3. Study Controls	Medium	The study did not require concurrent control groups; analytical blanks were included.	2	2	4

	4. Test Substance Stability	Low	Samples were prepared in a previous study cited; reference date was 2 years prior to the publish date; storage and stability of samples were not reported.	3	1	3
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Additional information in supporting information.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Medium	Limited detail was provided; however, this did not hinder the interpretation of the results.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Limited data; additional data with supporting document; injection temperature of analytical method was not specified for isomeric resolution.	2	2	4

	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	20	20	27
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.35	**Overall Score (Rounded):**	1.4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High[1]
[1]It is noted that information in Table 1 was used to calculate lipid normalized BAF's.						

Study Reference:	**Kim, GB; Stapleton, HM. (2010). PBDEs, methoxylated PBDEs and HBCDs in Japanese common squid (Todarodes pacificus) from Korean offshore waters. Mar Pollut Bull 60: 935-940. http://dx.doi.org/10.1016/j.marpolbul.2010.03.025. HERO ID: 1927684**					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means.	1	1	1
Test Design	3. Study Controls	Medium	Quality controls were included; HBCD was not detected in analytical blanks. The source and purity of analytical standards were not reported.	2	2	4
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2

	7. Testing Consistency	High	Test conditions were consistent across samples; environmental samples were treated equally.	1	1	1
	8. System Type and Design	Medium	Concentrations were measured in biota only and not in waters where biota were collected.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Low	Not a routine species. The squid was selected to document environmental contamination off Korean waters and the tissue were frozen and also used in a different publication.	3	2	6
Outcome Assessment	11. Outcome Assessment Methodology	Unacceptable	BAF/BCF values were not reported. Study documents HBCD concentrations in squid, rather than calculating BAF/BCF values in these organisms.	4	1	4
	12. Sampling Methods	Medium	Limited detail was provided; a different publication was cited that may provide more information.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability were examined statistically; no confounding factors were reported.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Concentrations of HCBD isomers were reported and lipid-normalized, although samples were not corrected for % recovery.	1	2	2

	16. Statistical Methods and Kinetic Calculations	High	Appropriate statistical tests were used to determine potential differences in concentrations between study areas, and to examine relationships between HBCD isomers.	1	1	1
Other	17. Verification or Plausibility of Results	High	Pattern of HBCD composition seen in squid was very similar to that seen in other studies.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	23	20	31
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.55	**Overall Score (Rounded):**	4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Unacceptable[1]

[1]Monitoring study where BAF/BCF values were not reported. Consistent with our Application of Systematic Review in TSCA Risk Evaluations document, if a metric for a data source receives a score of Unacceptable (score = 4), EPA will determine the study to be unacceptable. In this case, one of the metrics was rated as unacceptable. As such, the study is considered unacceptable and the score is presented solely to increase transparency.

Study Reference:	Harrad, S; Abdallah, MA; Rose, NL; Turner, SD; Davidson, TA. (2009). Current-use brominated flame retardants in water, sediment, and fish from English lakes. Environ Sci Technol 43: 9077-9083. http://dx.doi.org/10.1021/es902185u. HERO ID: 1927694					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means. Source of analytical standards was reported.	1	1	1
Test Design	3. Study Controls	High	Replicate analysis was used for method reproducibility and accuracy and was described in detail in supplemental information.	1	2	2
	4. Test Substance Stability	Medium	The test substance stability and storage conditions were not reported; however, these factors were not likely to have influenced the test substance or were not likely to have had a substantial impact on the study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	Medium	There were minor omissions in testing conditions; however, the omissions were not likely to have had a substantial impact on the study results.	2	2	4
	7. Testing Consistency	Medium	There were likely minor inconsistencies in test conditions across samples or study groups as various sampling sites were used and several organisms sampled; however, this was not likely to have hindered the interpretation of the results.	2	1	2

	8. System Type and Design	Medium	Field study; equilibrium was not confirmed or reported; the deviation may have limited strict interpretation of the study results.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Medium	Details on each species not included; field study investigated concentrations in aquatic species.	2	2	4
Outcome Assessment	11. Outcome Assessment Methodology	High	Outcome assessment methodology reported the intended outcomes of interest.	1	1	1
	12. Sampling Methods	High	Sampling methods were adequate for the outcomes of interest; additional detail was provided in supporting information.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Potential confounding variables and uncertainties were discussed and accounted for in the study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Details regarding chemical concentrations, partitioning, percent recovery, and method accuracy were described in the paper and supporting information.	1	2	2
	16. Statistical Methods and Kinetic Calculations	Low	Statistical analyses were not reported.	3	1	3
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	22	20	29
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.45	**Overall Score (Rounded):**	1.5
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Harrad, S; Abdallah, MA; Rose, NL; Turner, SD; Davidson, TA. (2009). Current-use brominated flame retardants in water, sediment, and fish from English lakes. Environ Sci Technol 43: 9077-9083. http://dx.doi.org/10.1021/es902185u. HERO ID: 1927694					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means. Source of analytical standards was reported.	1	1	1
Test Design	3. Study Controls	High	Replicate analysis was used for method reproducibility and accuracy and was described in detail in supplemental information.	1	2	2
	4. Test Substance Stability	Medium	The test substance stability and storage conditions were not reported; however, these factors were not likely to have influenced the test substance or were not likely to have had a substantial impact on the study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	Medium	There were minor omissions in testing conditions; however, the omissions were not likely to have had a substantial impact on the study results.	2	2	4

	7. Testing Consistency	Medium	There were likely minor inconsistencies in test conditions across samples or study groups as various sampling sites were used and several organisms sampled; however, this was not likely to have hindered the interpretation of the results.	2	1	2
	8. System Type and Design	Medium	Field study; equilibrium was not confirmed or reported; the deviation may have limited strict interpretation of the study results.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Medium	Details on each species not included; field study investigated concentrations in aquatic species.	2	2	4
Outcome Assessment	11. Outcome Assessment Methodology	High	Outcome assessment methodology reported the intended outcomes of interest.	1	1	1
	12. Sampling Methods	High	Sampling methods were adequate for the outcomes of interest; additional detail was provided in supporting information.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Potential confounding variables and uncertainties were discussed and accounted for in the study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Data Presentation and Analysis	15. Data Reporting	High	Details regarding chemical concentrations, partitioning, percent recovery, and method accuracy were described in the paper and supporting information.	1	2	2
	16. Statistical Methods and Kinetic Calculations	Low	Statistical analyses were not reported.	3	1	3
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	22	20	29
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.45	**Overall Score (Rounded):**	1.5
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Harrad, S; Abdallah, MA; Rose, NL; Turner, SD; Davidson, TA. (2009). Current-use brominated flame retardants in water, sediment, and fish from English lakes. Environ Sci Technol 43: 9077-9083. http://dx.doi.org/10.1021/es902185u. HERO ID: 1927694					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means. Source of analytical standards was reported.	1	1	1
Test Design	3. Study Controls	High	Replicate analysis was used for method reproducibility and accuracy and was described in detail in supplemental information.	1	2	2
	4. Test Substance Stability	Medium	The test substance stability and storage conditions were not reported; however, these factors were not likely to have influenced the test substance or were not likely to have had a substantial impact on the study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	Medium	There were minor omissions in testing conditions; however, the omissions were not likely to have had a substantial impact on the study results.	2	2	4
	7. Testing Consistency	Medium	There were likely minor inconsistencies in test conditions across samples or study groups as various sampling sites were used and several organisms sampled; however, this was not likely to have hindered the interpretation of the results.	2	1	2

	8. System Type and Design	Medium	Field study; equilibrium was not confirmed or reported; the deviation may limit strict interpretation of the study results.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Medium	Details on each species not included; field study investigated concentrations in aquatic species.	2	2	4
Outcome Assessment	11. Outcome Assessment Methodology	High	Outcome assessment methodology reported the intended outcomes of interest.	1	1	1
	12. Sampling Methods	High	Sampling methods were adequate for the outcomes of interest; additional detail was provided in supporting information.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Potential confounding variables and uncertainties were discussed and accounted for in the study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Details regarding chemical concentrations, partitioning, percent recovery, and method accuracy were described in the paper and supporting information.	1	2	2
	16. Statistical Methods and Kinetic Calculations	Low	Statistical analyses were not reported.	3	1	3
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	22	20	29
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.45	**Overall Score (Rounded):**	1.5
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Harrad, S; Abdallah, MA; Rose, NL; Turner, SD; Davidson, TA. (2009). Current-use brominated flame retardants in water, sediment, and fish from English lakes. Environ Sci Technol 43: 9077-9083. http://dx.doi.org/10.1021/es902185u. HERO ID: 1927694					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means. Source of analytical standards was reported.	1	1	1
Test Design	3. Study Controls	High	Replicate analysis was used for method reproducibility and accuracy and was described in detail in supplemental information.	1	2	2
	4. Test Substance Stability	Medium	The test substance stability and storage conditions were not reported; however, these factors were not likely to have influenced the test substance or were not likely to have had a substantial impact on the study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	Medium	There were minor omissions in testing conditions; however, the omissions were not likely to have had a substantial impact on the study results.	2	2	4
	7. Testing Consistency	Medium	There were likely minor inconsistencies in test conditions across samples or study groups as various sampling sites were used and several organisms sampled; however, this is not likely to have hindered the interpretation of the results.	2	1	2

	8. System Type and Design	Medium	Field study; equilibrium was not confirmed or reported; the deviation may have limited strict interpretation of the study results.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Medium	Details on each species not included; field study investigated concentrations in aquatic species.	2	2	4
Outcome Assessment	11. Outcome Assessment Methodology	High	Outcome assessment methodology reported the intended outcomes of interest.	1	1	1
	12. Sampling Methods	High	Sampling methods were adequate for the outcomes of interest; additional detail was provided in supporting information.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Potential confounding variables and uncertainties were discussed and accounted for in the study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Details regarding chemical concentrations, partitioning, percent recovery, and method accuracy were described in the paper and supporting information.	1	2	2
	16. Statistical Methods and Kinetic Calculations	Medium	Statistical analysis of the results was indicated; however, data relating to the specific results were not provided.	2	1	2
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	21	20	28
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.4	**Overall Score (Rounded):**	1.4

≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Jenssen, BM; Sørmo, EG; Baek, K; Bytingsvik, J; Gaustad, H; Ruus, A; Skaare, JU. (2007). Brominated flame retardants in North-East Atlantic marine ecosystems. Environ Health Perspect 115 Suppl 1: 35-41. http://dx.doi.org/10.1289/ehp.9355. HERO ID: 1927762					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means.	1	1	1
Test Design	3. Study Controls	Medium	Source and purity of analytical standards not reported.	2	2	4
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation. No confounding variables were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	20	21
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.1	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	van Beusekom, OC; Eljarrat, E; Barceló, D; Koelmans, AA. (2006). Dynamic modeling of food-chain accumulation of brominated flame retardants in fish from the Ebro River Basin, Spain. Environ Toxicol Chem 25: 2553-2560. http://dx.doi.org/10.1897/05- 409R.1. HERO ID: 1927786					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	Not reported; modeling study was based on measured concentrations from a separate study.	2	1	2
Test Design	3. Study Controls	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	Not rated	The metric is not applicable to this study type (using environmental samples).	NR	NR	NR
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

	12. Sampling Methods	Medium	Not reported; modeling study based on measured concentrations from a separate study; no details were provided on the measured concentrations used for comparison; however, the reference was cited.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	15	17	19
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.12	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Tomy, GT; Budakowski, W; Halldorson, T; Whittle, DM; Keir, MJ; Marvin, C; Macinnis, G; Alaee, M. (2004). Biomagnification of alpha- and gamma-hexabromocyclododecane isomers in a Lake Ontario food web. Environ Sci Technol 38: 2298-2303. http://dx.doi.org/10.1021/es034968h. HERO ID: 1927822					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means. Source and purity of analytical standards were reported.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	Low	Analytical method did not make note of method temperatures for consideration of thermal isomerization.	3	1	3
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	This metric met the criteria for high confidence as expected for this type of study. Trophic levels were confirmed in previous study using stable isotopes.	1	2	2

Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Medium	Limited details were provided regarding this metric.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation. No confounding variables were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	There were omissions in analytical method detail; did not make note of method temperatures for consideration of thermal isomerization.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Medium	Statistical analysis of the data set was not reported.	2	1	2
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	20	20	26
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.3	**Overall Score (Rounded):**	1.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Wildlife Intl LTD (Wildlife International Limited). (2000). Letter from Amer Chem Cncl submitting flow-through bioconcentration test w/rainbow trout and end-user survey- phase 1 study of brominated flame retardant, w/attchmts and dated 8/28/00 [TSCA Submission]. (EPA/OTS Doc #FYI-OTS-1000-1392). Arlington, VA: American Chemistry Council. HERO ID: 1928244					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The source and purity of the test substance were reported.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	The test substance stability was considered in this study.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Test organism information was reported. The test organism was routinely used for similar study types.	1	2	2

Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	Medium	Some details were limited (% lipids was not reported); however, this did not limit the interpretation of the results.	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	The analysis of data was clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	20	21
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.05	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Zhang, Y; Sun, H; Zhu, H; Ruan, Y; Liu, F; Liu, X. (2014). Accumulation of hexabromocyclododecane diastereomers and enantiomers in two microalgae, Spirulina subsalsa and Scenedesmus obliquus. Ecotoxicol Environ Saf 104: 136-142. http://dx.doi.org/10.1016/j.ecoenv.2014.02.027. HERO ID: 2343690					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Source and purity of chemicals were reported.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	Tested at 2 ng/mL (lowest solubility is gamma-HBCD (2.08 ng/mL).	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type study type.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Test organism information was reported. The test organism was routinely used for similar study types.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation.	1	1	1
	14. Outcomes Unrelated to Exposure	High	There were no differences noted between the study groups due to organism attrition.	1	1	1
Data Presentation and Analysis	15. Data Reporting	Low	Transformation products were reported. Recoveries were said to be acceptable but were not.	3	2	6
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	18	21	25
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.19	**Overall Score (Rounded):**	1.2
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Zhang, Y; Sun, H; Liu, F; Dai, Y; Qin, X; Ruan, Y; Zhao, L; Gan, Z. (2013). Hexabromocyclododecanes in limnic and marine organisms and terrestrial plants from Tianjin, China: diastereomer- and enantiomer-specific profiles, biomagnification, and human exposure. Chemosphere 93: 1561-1568. http://dx.doi.org/10.1016/j.chemosphere.2013.08.004. HERO ID: 2343741					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Source and purity of chemicals were reported.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	No omissions about the testing conditions were likely to have impacted the study results.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Test species were clearly reported and have been used in other studies, which were cited as references for the results.	1	2	2

Outcome Assessment	11. Outcome Assessment Methodology	High	Diastereomeric profiles and trophic magnification factors can be appropriately reported using this assessment methodology.	1	1	1
	12. Sampling Methods	High	No sampling limitations were noted that would have influenced the study results.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty were addressed using triplicate analysis and internal standards. No confounding differences between study groups were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	High	No differences in attrition between organisms were reported.	1	1	1
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	Results were reasonable and were compared to the results of other similar studies.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	21	21
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1	**Overall Score (Rounded):**	1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Bradshaw, C; Strid, A; von Stedingk, H; Gustafsson, K. (2015). Effects of benthos, temperature, and dose on the fate of hexabromocyclododecane in experimental coastal ecosystems. Environ Toxicol Chem 34: 1246-1257. http://dx.doi.org/10.1002/etc.2947. HERO ID: 3013490					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source and purity were reported.	1	1	1
Test Design	3. Study Controls	Low	Some details were omitted regarding this metric, including a field blank, but may be found in supplemental data.	3	2	6
	4. Test Substance Stability	Medium	Some details were omitted regarding this metric; however, this was not likely to have influenced the results.	2	1	2
Test Conditions	5. Test Method Suitability	Low	Concentrations were above the water solubility of HBCD.	3	1	3
	6. Testing Conditions	Low	Some details were omitted regarding this metric but may be found in supplemental data.	3	2	6
	7. Testing Consistency	Medium	Variation due to the use of data from 3 experiments; results were graphed together and not clearly reported separately.	2	1	2
	8. System Type and Design	Medium	Some details were omitted regarding this metric; may be found in supplemental data.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Medium	Some details were omitted regarding this metric; may be found in supplemental data.	2	2	4
Outcome Assessment	11. Outcome Assessment Methodology	Low	Some details were omitted regarding this metric; may be found in supplemental data.	3	1	3

	12. Sampling Methods	Low	Some details were omitted regarding this metric; may be found in supplemental data.	3	1	3
Confounding / Variable Control	13. Confounding Variables	Not rated	No confounding variables were noted.	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Not rated	Several details were placed in the supplemental document, which was not readily available.	NR	NR	NR
	16. Statistical Methods and Kinetic Calculations	Medium	Inconsistent across the three experiments; data were not provided but may be found in supplemental data.	2	1	2
Other	17. Verification or Plausibility of Results	Low	Should be linked with its supplemental data for a more thorough evaluation.	3	1	3
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	30	17	39
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	2.29	**Overall Score (Rounded):**	3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Low[1]
[1] This study's overall quality rating was downgraded: Supplemental data required for a more thorough evaluation.						

Study Reference:	Baron, E; Gimenez, J; Verborgh, R; Gauffier, P; De Stephanis, R; Eljarrat, E; Barcelo, D. (2015). Bioaccumulation and biomagnification of classical flame retardants, related halogenated natural compounds and alternative flame retardants in three delphinids from Southern European waters. Environ Pollut 203: 107-115. http://dx.doi.org/10.1016/j.envpol.2015.03.041. HERO ID: 3327242					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Not rated	Test substance purity not reported.	NR	NR	NR
Test Design	3. Study Controls	Low	Study controls not reported.	3	2	6
	4. Test Substance Stability	Not rated	Test substance stability not reported.	NR	NR	NR
Test Conditions	5. Test Method Suitability	Medium	Test method details provided in the paper were limited. Details are present in supplementary data (which can be found at http://dx.doi.org/10.1 016/j.envpol.2015.03. 041), which is access controlled through a subscription.	2	1	2
	6. Testing Conditions	High	Testing conditions were well defined.	1	2	2
	7. Testing Consistency	High	Testing consistency well defined.	1	1	1
	8. System Type and Design	Medium	System type and design not well defined in article, as detailed information was presented in supplementary information, which is available on a subscription basis.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	Not reported.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	Not reported.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	Not rated	Not reported.	NR	NR	NR
	12. Sampling Methods	High	Sampling methods were well defined.	1	1	1

Confounding / Variable Control	13. Confounding Variables	Not rated	Not reported.	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	Not reported.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Low	Data reporting was not well defined. Detailed information was presented in supplementary information, which was available on a subscription basis.	3	2	6
	16. Statistical Methods and Kinetic Calculations	Low	Not well defined in current source.	3	1	3
Other	17. Verification or Plausibility of Results	Low	Detailed information presented in supplementary article.	3	1	3
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	20	14	28
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	2	**Overall Score (Rounded):**	2
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Medium

Study Reference:	Baron, E; Gimenez, J; Verborgh, R; Gauffier, P; De Stephanis, R; Eljarrat, E; Barcelo, D. (2015). Bioaccumulation and biomagnification of classical flame retardants, related halogenated natural compounds and alternative flame retardants in three delphinids from Southern European waters. Environ Pollut 203: 107-115. http://dx.doi.org/10.1016/j.envpol.2015.03.041. HERO ID: 3327242					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Not rated	Test substance purity not reported.	NR	NR	NR
Test Design	3. Study Controls	Low	Study controls not reported.	3	2	6
	4. Test Substance Stability	Not rated	Test substance stability not reported.	NR	NR	NR
Test Conditions	5. Test Method Suitability	Medium	Test method details provided in the paper were limited. Details are present in supplementary data (which can be found at http://dx.doi.org/10.1 016/j.envpol.2015.03. 041), which is access controlled through a subscription.	2	1	2
	6. Testing Conditions	High	Testing conditions were well defined.	1	2	2
	7. Testing Consistency	High	Testing consistency well defined.	1	1	1
	8. System Type and Design	Medium	System type and design not well defined in article, as detailed information was presented in supplementary information, which is available on a subscription basis.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	Not reported.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	Not reported.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	Not rated	Not reported.	NR	NR	NR
	12. Sampling Methods	High	Sampling methods were well defined.	1	1	1

Confounding / Variable Control	13. Confounding Variables	Not rated	Not reported.	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	Not reported.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Low	Data reporting was not well defined. Detailed information was presented in supplementary information, which was available on a subscription basis.	3	2	6
	16. Statistical Methods and Kinetic Calculations	Low	Not well defined in current source.	3	1	3
Other	17. Verification or Plausibility of Results	Low	Detailed information presented in supplementary article.	3	1	3
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	20	14	28
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	2	**Overall Score (Rounded):**	2
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Medium

Study Reference:	Baron, E; Gimenez, J; Verborgh, R; Gauffier, P; De Stephanis, R; Eljarrat, E; Barcelo, D. (2015). Bioaccumulation and biomagnification of classical flame retardants, related halogenated natural compounds and alternative flame retardants in three delphinids from Southern European waters. Environ Pollut 203: 107-115. http://dx.doi.org/10.1016/j.envpol.2015.03.041. HERO ID: 3327242					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Not rated	Test substance purity not reported.	NR	NR	NR
Test Design	3. Study Controls	Low	Study controls not reported.	3	2	6
	4. Test Substance Stability	Not rated	Test substance stability not reported.	NR	NR	NR
Test Conditions	5. Test Method Suitability	Medium	Test method details provided in the paper were limited. Details are present in supplementary data (which can be found at http://dx.doi.org/10.1 016/j.envpol.2015.03. 041), which is access controlled through a subscription.	2	1	2
	6. Testing Conditions	High	Testing conditions were well defined.	1	2	2
	7. Testing Consistency	High	Testing consistency well defined.	1	1	1
	8. System Type and Design	Medium	System type and design not well defined in article, as detailed information was presented in supplementary information, which is available on a subscription basis.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	Not reported.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	Not reported.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	Not rated	Not reported.	NR	NR	NR
	12. Sampling Methods	High	Sampling methods were well defined.	1	1	1

Confounding / Variable Control	13. Confounding Variables	Not rated	Not reported.	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	Not reported.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Low	Data reporting was not well defined. Detailed information was presented in supplementary information, which was available on a subscription basis.	3	2	6
	16. Statistical Methods and Kinetic Calculations	Low	Not well defined in current source.	3	1	3
Other	17. Verification or Plausibility of Results	Low	Detailed information presented in supplementary article.	3	1	3
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	20	14	28
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	2	**Overall Score (Rounded):**	2
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Medium

Study Reference:	Tang, B; Zeng, YH; Luo, XJ; Zheng, XB; Mai, BX. (2015). Bioaccumulative characteristics of tetrabromobisphenol A and hexabromocyclododecanes in multi-tissues of prey and predator fish from an e-waste site, South China. Environ Sci Pollut Res Int 22: 12011- 12017. http://dx.doi.org/10.1007/s11356-015-4463-1. HERO ID: 3350534					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified definitively by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was able to be identified by the analytical method.	1	1	1
Test Design	3. Study Controls	High	Spiked blanks and spiked matrices were tested to determine recoveries.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	Medium	Conditions in the water from which the fish were taken were not clearly reported but were unlikely to have impacted the study results.	2	2	4
	7. Testing Consistency	High	Samples were taken from the same pond and underwent the same sample preparation.	1	1	1
	8. System Type and Design	Not rated	Not applicable.	NR	NR	NR
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Information about the species tested was given and the two selected species were appropriate for the study.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	Outcome assessment methodology addressed the intended outcomes of interest in the study.	1	1	1

	12. Sampling Methods	Not rated	Samples were only analyzed once so the adequacy of sampling timing and frequency was not applicable.	NR	NR	NR
Confounding / Variable Control	13. Confounding Variables	Medium	Percent lipid was not reported, although concentrations were reported as lipid-normalized.	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Percent recovery and lipid normalized BCFs were reported.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	Statistical methods were outlined and appropriate to the study evaluation. No kinetic calculations were made.	1	1	1
Other	17. Verification or Plausibility of Results	High	Several other studies were cited at various points that validated the study results as being reasonable.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	15	18	21
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.17	**Overall Score (Rounded):**	1.2
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Zhu, C; Wang, P; Li, Y; Chen, Z; Li, H; Ssebugere, P; Zhang, Q; Jiang, G. (2017). Trophic transfer of hexabromocyclododecane in the terrestrial and aquatic food webs from an e- waste dismantling region in East China. Environ Sci Process Impacts 19: 154-160. http://dx.doi.org/10.1039/c6em00617e. HERO ID: 3546047					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means.	1	1	1
Test Design	3. Study Controls	Medium	The purity of the analytical standards was not reported, but this was unlikely to have affected the outcome.	2	2	4
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	Medium	Oxygen level, pH, hardness, etc. of the water at the sampling site were not reported, but this was unlikely to have affected the results.	2	2	4
	7. Testing Consistency	High	All fish samples were treated equally	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR

	10. Test Organism Partitioning	High	This metric met the criteria for high confidence as expected for this type of study. Test organism information was reported.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	Low	All results were considered statically insignificant due in part to the limited number of species.	3	1	3
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	The analysis of data was clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	Low	Practical comparison with other studies of this type was impossible as the results were considered not statically significant.	3	1	3
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	21	20	28
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.4	**Overall Score (Rounded):**	1.4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Zhu, H; Zhang, K; Sun, H; Wang, F; Yao, Y. (2017). Spatial and temporal distributions of hexabromocyclododecanes in the vicinity of an expanded polystyrene material manufacturing plant in Tianjin, China. Environ Pollut 222: 338-347. http://dx.doi.org/10.1016/j.envpol.2016.12.029. HERO ID: 3546055					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means.	1	1	2
Test Design	3. Study Controls	Medium	The purity of the analytical standards was not reported, but this was unlikely to have affected the outcome.	2	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	Medium	Oxygen level, pH, hardness, etc. of the water at the sampling site were not reported, but this was unlikely to have affected the results.	2	2	4
	7. Testing Consistency	High	All fish samples were treated equally.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR

	10. Test Organism Partitioning	High	This metric met the criteria for high confidence as expected for this type of study. Test organism information was reported.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	Medium	A limited number of species was evaluated.	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	The analysis of data was clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	Medium	Similar studies gave similar TMFs values.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	19	20	25
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.25	**Overall Score (Rounded):**	1.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Guerra, P; De La Cal, A; Marsh, G; Eljarrat, E; Barcelo, D. (2009). Transfer of hexabromocyclododecane from industrial effluents to sediments and biota: Case study in Cinca River (Spain). J Hydrol 369: 360-367. http://dx.doi.org/10.1016/j.jhydrol.2009.02.024. HERO ID: 3575325					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified definitively by chemical name.	1	2	2
	2. Test Substance Purity	High	Analytical procedures used to measure the isomeric and enantiomeric composition of HBCD were discussed in depth. No impurities were reported in that section and therefore were unlikely to have impacted the study results.	1	1	1
Test Design	3. Study Controls	High	For the depuration experiment, 2 weeks of acclimation were allowed for the zebrafish in the test water before being exposed to HBCD. 40 zebrafish were then measured at time 0 to establish background concentrations of HBCD. For the in situ bioaccumulation experiment, barbels were exposed at an upstream site as a control, compared to fish exposed at a downstream contaminated site.	1	2	2
	4. Test Substance Stability	Medium	The test solution preparation was not clearly reported but was unlikely to have affected the study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1

	6. Testing Conditions	Medium	Not reported but not likely to have influenced the study results.	2	2	4
	7. Testing Consistency	High	Test conditions were consistent across sample groups.	1	1	1
	8. System Type and Design	Medium	Relative standard deviations in the total HBCD concentrations reported were low, suggesting equilibrium was established amongst the study group. However, the study design was not reported very clearly.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Test organism information was reported. The test organism was routinely used for similar study types.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	High	Methods used to collect effluent, sediment and fish samples were described in general; and were appropriate for the study goals.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Collecting a range of environmental samples over several years could have introduced the potential for uncertainty and variability; however, this was addressed by using rigorous analytical techniques and statistical analysis. No confounding variables were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Data Presentation and Analysis	15. Data Reporting	High	The analytical method was suitable for detection of the parent compound. Percent recovery was not reported but was not likely to have influenced the study results.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	The percent decrease of HBCD after 9 and 16 days of depuration was reported.	1	1	1
Other	17. Verification or Plausibility of Results	Medium	No reference substance was noted but study results were reasonable. Concentrations of HBCD in sediment were consistent with data reported for other river sediments. HBCD concentrations in downstream samples were consistently higher than those of upstream samples.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	19	20	25
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.25	**Overall Score (Rounded):**	1.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	U.S. EPA (U.S. Environmental Protection Agency). (2017). IUCLID data set: hexbromocyclododecane. Retrieved from https://java.epa.gov/oppt_chemical_search/. HERO ID: 3970216					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	Exact purity was not specified but reported to be a composite of commercial grade HBCD, so any impurities were not likely to have impacted the study results.	2	1	2
Test Design	3. Study Controls	High	Although not specifically reported, the study was performed following EPA, OECD and GLP guidelines.	1	2	2
	4. Test Substance Stability	Medium	The test substance preparation and storage conditions were not reported but were unlikely to have impacted the study results.	2	1	2
Test Conditions	5. Test Method Suitability	Medium	The test substance was tested at the aqueous solubility of gamma-HBCD, the major component of the isomeric mixture.	2	1	2
	6. Testing Conditions	Medium	Several details regarding the testing conditions were not reported in the summary but assuming the test followed EPA OPPTS guideline, these omissions should not disqualify the study results.	2	2	4
	7. Testing Consistency	High	Although not specifically reported, the study was performed following EPA, OECD and GLP guidelines.	1	1	1

	8. System Type and Design	High	Although not specifically reported, the study was performed following EPA, OECD and GLP guidelines.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Test organism information was reported. The test organism was routinely used for similar study types.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Variability in the measured water concentration for the 0.34ug/L nominal concentration test was expected due to an observed spike in uptake on the last day of exposure but was accounted for when reporting results. No other differences between the study groups were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Lipid content was not reported but was not likely to have substantially impacted the study results.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Medium	Statistical methods and kinetic calculations were not clearly reported but not likely to have impacted the study results.	2	1	2
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	21	20	28
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.4	**Overall Score (Rounded):**	1.4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	ECHA (European Chemicals Agency). (2017). Bioaccumulation: aquatic/sediment: hexabromocyclododecane. Helsinki, Finland. Retrieved from https://echa.europa.eu/registration-dossier/-/registered-dossier/15003/5/4/2#. HERO ID: 3970741					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	Common name was used, and isomer components were listed.	1	2	2
	2. Test Substance Purity	High	No impurities were noted in the test material analysis.	1	1	1
Test Design	3. Study Controls	High	Solvent control was used. Acetone (vehicle) with no HBCD was added to treatment group at same concentration as in other test groups.	1	2	2
	4. Test Substance Stability	High	Preparation of test substance was reported.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was described and is suitable for the test substance.	1	1	1
	6. Testing Conditions	High	Testing conditions (dissolved oxygen, pH, temperature, alkalinity, conductance) were monitored and reported.	1	2	2
	7. Testing Consistency	High	Sampling time and frequency and testing conditions were the same across testing groups.	1	1	1
	8. System Type and Design	High	Achievement of a steady state was determined by the measurement of three consecutive, non-significantly different, uptake concentrations.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Test organism information was reported. The test organism was routinely used for similar study types.	1	2	2

Outcome Assessment	11. Outcome Assessment Methodology	Medium	Analysis method for measuring HBCD concentrations in the fish tissue was not reported; however, as long as an appropriate method was used to do it measuring HBCD concentrations in the fish tissue was an appropriate outcome to use for determining BCFs.	2	1	2
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation. No confounding variables were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Analytical method was not reported; however, this was not likely to have substantially impacted the results.	2	2	4
	16. Statistical Methods and Kinetic Calculations	High	Statistical methods and calculations were clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	Medium	No reference substance was reported but the study results were reasonable.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	18	20	24
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.2	**Overall Score (Rounded):**	1.2
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	ECHA (European Chemicals Agency). (2017). Bioaccumulation: aquatic/sediment: hexabromocyclododecane. Helsinki, Finland. Retrieved from https://echa.europa.eu/registration-dossier/-/registered-dossier/15003/5/4/2#. HERO ID: 3970741					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	Common name was used, and isomer components were listed.	1	2	2
	2. Test Substance Purity	High	No impurities were noted in the test material analysis.	1	1	1
Test Design	3. Study Controls	High	Solvent control was used. Acetone (vehicle) with no HBCD was added to a treatment group at same concentrations as in other test groups.	1	2	2
	4. Test Substance Stability	High	Preparation of test substance was reported.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was reported and is suitable for the test substance.	1	1	1
	6. Testing Conditions	High	Testing conditions (dissolved oxygen, pH, temperature, alkalinity, conductance) were monitored and reported.	1	2	2
	7. Testing Consistency	High	Sampling time and frequency and testing conditions were the same across testing groups.	1	1	1
	8. System Type and Design	High	Test apparatus was capable of appropriately maintaining exposure concentrations; both nominal and measured concentrations of HBCD were reported.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Test organism information was reported. The test organism was routinely used for similar study types.	1	2	2

Outcome Assessment	11. Outcome Assessment Methodology	Medium	Method of analysis for measuring HBCD concentrations in the fish tissue was not reported. However, as long as an appropriate method was used to do it, measuring HBCD concentrations in the fish tissue was an appropriate outcome to use for determining BCFs.	2	1	2
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation. No confounding variables were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Analytical method was not reported; however, this was not likely to have substantially impacted the results.	2	2	4
	16. Statistical Methods and Kinetic Calculations	High	Statistical methods and calculations were clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	High	No reference substance was reported but study results were reasonable.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	17	20	23
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.15	**Overall Score (Rounded):**	1.2
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	ECHA (European Chemicals Agency). (2017). Bioaccumulation: aquatic/sediment: hexabromocyclododecane. Helsinki, Finland. Retrieved from https://echa.europa.eu/registration-dossier/-/registered-dossier/15003/5/4/2#. HERO ID: 3970741					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	Common name was used, and isomer components were listed.	1	2	2
	2. Test Substance Purity	High	No impurities were noted in the test material analysis.	1	1	1
Test Design	3. Study Controls	High	Solvent control used. Acetone (vehicle) with no HBCD added to treatment group at same concentration as in other test groups.	1	2	2
	4. Test Substance Stability	High	Preparation of test substance was reported.	1	1	1
Test Conditions	5. Test Method Suitability	High	Test method was reported and was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	Testing conditions (dissolved oxygen, pH, temperature, alkalinity, conductance) were monitored and reported.	1	2	2
	7. Testing Consistency	High	Sampling time and frequency and testing conditions were the same across testing groups.	1	1	1
	8. System Type and Design	High	Steady state was determined by the measurement of three consecutive, non-significantly different, uptake concentrations.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Test organism information was reported. The test organism was routinely used for similar study types.	1	2	2

Outcome Assessment	11. Outcome Assessment Methodology	Medium	Method of analysis for measuring HBCD concentrations in the fish tissue was not reported. However, as long as an appropriate method was used to do it, measuring HBCD concentrations in the fish tissue was an appropriate outcome to measure for determining uptake and depuration rates.	2	1	2
	12. Sampling Methods	High	The sampling time and frequency appeared to be appropriate for this study and were consistent with the guideline cited.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation. No confounding variables were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Analytical method was not reported; however, this was not likely to have substantially impacted the results.	2	2	4
	16. Statistical Methods and Kinetic Calculations	High	Statistical methods and calculations were clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	Medium	No reference substance was reported but the study results were reasonable.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	18	20	24
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.2	**Overall Score (Rounded):**	1.2
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Law, K; Halldorson, T; Danell, R; Stern, G; Gewurtz, S; Alaee, M; Marvin, C; Whittle, M; Tomy, G. (2007). Erratum: Bioaccumulation and trophic transfer of some brominated flame retardants in a Lake Winnipeg (Canada) food web. Environ Toxicol Chem 26: 190. http://dx.doi.org/10.1002/etc.5620260125. HERO ID: 4140418					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means. Source and purity of analytical standards reported.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	Low	Analytical method did not make note of method temperatures for consideration of thermal isomerization.	3	1	3
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	This metric met the criteria for high confidence as expected for this type of study. Trophic levels confirmed in previous study using stable isotopes.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Medium	Limited details were provided regarding this metric.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation. No confounding variables were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	There were omissions in analytical method detail; did not make note of method temperatures for consideration of thermal isomerization.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Medium	Statistical analysis of the data set was not reported.	2	1	2
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	19	18	24
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.33	**Overall Score (Rounded):**	1.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Chemicals Inspection and Testing Institute Japan. (1995). Final report: Bioconcentration study of hexabromocyclododecane in carp conducted with 1,2,5,6,9,10-hexabromocyclododecane (test substance no. K-1035). Chemical Biotesting Center, Kurume Laboratory. HERO ID: 4140430					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance purity was reported.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	Medium	Guideline method reported; however, some testing conditions (pH, TOC, and hardness) were not reported.	2	2	4
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2

Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Several figures referenced were not in the report.	2	2	4
	16. Statistical Methods and Kinetic Calculations	High	The analysis of data was clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	17	20	24
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.2	**Overall Score (Rounded):**	1.2
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Netherlands Institute for Fisheries Research. (2002). Polybrominated diphenylethers in the aquatic environment. (OTS: NA; 8EHQ Num: 8EHQ-0702-15166C; DCN: 89030000022; TSCATS RefID: NA; CIS: 8EHQ-02-15166). HERO ID: 4269990					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified definitively by chemical name.	1	2	2
	2. Test Substance Purity	High	Chemical was analyzed by MS from environmental samples.	1	1	1
Test Design	3. Study Controls	Not rated	Not applicable; the study did not require concurrent control groups.	NR	NR	NR
	4. Test Substance Stability	Not rated	The metric is not applicable to this study type (using environmental samples).	NR	NR	NR
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	Medium	Testing conditions were not fully reported; however, sufficient details were provided to interpret study.	2	2	4
	7. Testing Consistency	Not rated	The metric is not applicable to this study type (using environmental samples).	NR	NR	NR
	8. System Type and Design	Not rated	The metric is not applicable to this study type (using environmental samples).	NR	NR	NR
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study, reporting a biomagnification factor.	1	1	1
	12. Sampling Methods	High	No notable uncertainties or limitations were expected to influence results.	1	1	1

Confounding / Variable Control	13. Confounding Variables	Low	Sources of variability and uncertainty in the measurements and statistical techniques were not considered or accounted for in data evaluation.	3	1	3
	14. Outcomes Unrelated to Exposure	Not rated	Environmental samples were collected. The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	The target chemical concentrations, extraction efficiency, percent recovery, and mass balance were not reported.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Medium	Concentrations were provided to perform calculations, calculations not described.	2	1	2
Other	17. Verification or Plausibility of Results	High	The study results were consistent with physical properties.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	15	22
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.47	**Overall Score (Rounded):**	1.5
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High[1]

[1]This study is related to another study, HERO ID 4269983, Great Lakes Chemical, C. (2002). HBCD and TBBP-A in sewage sludge, sediments and biota, including interlaboratory study. Final report of an environmental monitoring study in sewage sludge / HBCD and TBBP-A in sewage sludge, sediments and biota, including interlaboratory study.

Study Reference:	**Zhang, Y; Lu, Y; Wang, P; Shi, Y. (2018). Biomagnification of hexabromocyclododecane (HBCD) in a coastal ecosystem near a large producer in China: Human exposure implication through food web transfer. Sci Total Environ 624: 1213-1220. HERO ID: 5099158**					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2

	2. Test Substance Purity	High	The test substance was identified by analytical means. d18- γ-HBCD used as recovery determination standard.	1	1	1
Test Design	3. Study Controls	High	C13-γ-HBCD was used as a surrogate standard.	1	2	2
	4. Test Substance Stability	Medium	The test substance stability and storage conditions were not reported; however, these factors were not likely to have influenced the test substance or were not likely to have had a substantial impact on the study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	Medium	There were minor omissions in testing conditions; however, the omissions were not likely to have had a substantial impact on the study results.	2	2	4
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	Medium	Field study; equilibrium was not confirmed or reported; the deviation may have limited strict interpretation of the study results.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Medium	Outcome assessment methodology reported the intended outcomes of interest.	2	2	4
Outcome Assessment	11. Outcome Assessment Methodology	High	Sampling methods were adequate for the outcomes of interest; additional detail was provided in supporting information.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

Confounding / Variable Control	13. Confounding Variables	High	Potential confounding variables and uncertainties were discussed and accounted for in the study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Details regarding chemical concentrations, partitioning, percent recovery, and method accuracy were described in the paper and supporting information.	1	2	2
	16. Statistical Methods and Kinetic Calculations	Medium	Statistical analysis of the results was indicated; however, data relating to the specific results were not provided.	2	1	2
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	20	20	28
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.35	**Overall Score (Rounded):**	1.4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Veith, GD; DeFoe, DL; Bergstedt, BV. (1979). Measuring and estimating the bioconcentration factor of chemicals in fish. J Fish Res Board Can 36: 1040-1048. http://dx.doi.org/10.1139/f79-146. HERO ID: 58136					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Low	The purity of the test substance was neither indicated nor confirmed by analytical methods.	3	1	3
Test Design	3. Study Controls	Medium	Controls were used but were not discussed.	2	2	4
	4. Test Substance Stability	High	The test substance stability was accounted for and appropriate for the study.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	Medium	Some system details were omitted, and quality control measures were not included; however, these omissions were not likely to have had a substantial impact on the study results.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Test organism information was reported. The test organism was routinely used for similar study types.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty in the study were considered and accounted for in data evaluation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Lipid normalized BCF was not reported; initial exposure concentration was not included; concentration data over the course of the experiment were not included; precise interpretation of the results may be limited.	2	2	4
	16. Statistical Methods and Kinetic Calculations	High	Model assumed that uptake and depuration processes followed first-order kinetics.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	20	20	27
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.35	**Overall Score (Rounded):**	1.4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Sørmo, EG; Jenssen, BM; Lie, E; Skaare, JU. (2009). Brominated flame retardants in aquatic organisms from the North Sea in comparison with biota from the high Arctic marine environment. Environ Toxicol Chem 28: 2082-2090. http://dx.doi.org/10.1897/08-452.1. HERO ID: 947918					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means.	1	1	1
Test Design	3. Study Controls	Not rated	Not applicable; monitoring study. Solvent blanks were used to control for background contamination in the laboratory analyses.	NR	NR	NR
	4. Test Substance Stability	High	The test substance homogeneity and preparation were acceptable for the study. Details on stability and storage were not reported but were not likely to have impacted the study results.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	Limited details were provided on testing conditions; however, analytical procedures were described in detail.	1	2	2
	7. Testing Consistency	Not rated	Monitoring study. Test samples were analyzed consistently across organisms.	NR	NR	NR
	8. System Type and Design	High	Appropriate evaluation/use of monitoring data. Analytical design was appropriate for the test substance; selection of organisms sampled, sample locations and methods were adequate.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR

	10. Test Organism Partitioning	Medium	Details on each species were not included; field study investigated concentrations in aquatic species of different trophic levels.	2	2	4
Outcome Assessment	11. Outcome Assessment Methodology	Low	The assessment methodology did not address or report biomagnification factors.	3	1	3
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Body burdens of HBCD were found to be significantly affected by increasing lipid content. Author discussed the greater biomagnification potential of HBCD, compared to other test substances studied, as being a result of larger digestive absorption or greater resistance against biotransformation and biodegradation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Appropriate data were reported for the study, including lipid content of samples along with HBCD body burden, detection limits, and % recovery.	1	2	2
	16. Statistical Methods and Kinetic Calculations	Not rated	Statistical analyses were conducted using standard software; discussions of statistical significance included p values.	NR	NR	NR
Other	17. Verification or Plausibility of Results	Medium	As this study did not evaluate specific HBCD isomers yet indicated a great potential for biomagnification, the authors noted the need for bioaccumulation potentials of the different HBCD diastereomers at various trophic levels.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	16	20
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.31	**Overall Score (Rounded):**	1.3

≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High[1]
[1]This study is a non-guideline qualitative assessment of biomagnification in the natural environment. The study does not fit precisely into the data evaluation metrics; however, it is an acceptable, informative study.						

Study Reference:	Eljarrat, E; de la Cal, A; Raldua, D; Duran, C; Barceló, D. (2004). Occurrence and bioavailability of polybrominated diphenyl ethers and hexabromocyclododecane in sediment and fish from the Cinca River, a tributary of the Ebro River (Spain). Environ Sci Technol 38: 2603-2608. http://dx.doi.org/10.1021/es0301424. HERO ID: 999290					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means.	1	1	1
Test Design	3. Study Controls	Medium	Purity of internal standards was not specified.	2	2	4
	4. Test Substance Stability	Medium	Not reported but was not likely to have affected the outcome.	2	1	2
Test Conditions	5. Test Method Suitability	High	Appropriate for field analysis; extraction and analytical methods were appropriate.	1	1	1
	6. Testing Conditions	Medium	Aquatic parameters, such as pH, hardness, etc. of the river water were not specified, but this was unlikely to have affected the outcome.	2	2	4
	7. Testing Consistency	Not rated	The metric is not applicable to this study type (field study).	NR	NR	NR
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Medium	Test organism information was reported. The test organism was not routinely used for similar study types.	2	2	4
Outcome Assessment	11. Outcome Assessment Methodology	Low	Result was not a quantifiable value; depuration study was not performed.	3	1	3

	12. Sampling Methods	High	All fish samples were treated equally and were categorized for length, weight, age, and gender.	1	1	1
Confounding / Variable Control	13. Confounding Variables	Low	Correlation coefficients for length vs concentration were low.	3	1	3
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Low	Percent lipid of fish was not reported; degradation products were observed but not quantified or identified.	3	2	6
	16. Statistical Methods and Kinetic Calculations	Unacceptable	Result was qualitative: "bioaccumulation was indicated."	4	1	4
Other	17. Verification or Plausibility of Results	High	Although the result was qualitative, it is accurate.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	27	19	37
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.95	**Overall Score (Rounded):**	4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Unacceptable[1]

[1]Results reported without quantification and other study limitations (i.e., depuration not performed) hindering data evaluation. Consistent with our Application of Systematic Review in TSCA Risk Evaluations document, if a metric for a data source receives a score of Unacceptable (score = 4), EPA will determine the study to be unacceptable. In this case, one of the metrics was rated as unacceptable. As such, the study is considered unacceptable and the score is presented solely to increase transparency.

Study Reference:	Law, K; Halldorson, T; Danell, R; Stern, G; Gewurtz, S; Alaee, M; Marvin, C; Whittle, M; Tomy, G. (2006). Bioaccumulation and trophic transfer of some brominated flame retardants in a Lake Winnipeg (Canada) food web. Environ Toxicol Chem 25: 2177-2186. http://dx.doi.org/10.1897/05-500R.1. HERO ID: 999306					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source and purity were reported.	1	1	1
Test Design	3. Study Controls	High	Analytical quality assurance and quality controls were reported.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Medium	Details on each species were not included; field study investigated concentrations in aquatic species of different trophic levels.	2	2	4
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

Confounding / Variable Control	13. Confounding Variables	Not rated	No confounding variables were noted.	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	14	18	20
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.11	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	ECHA (European Chemicals Agency). (2017). Biodegradation in soil: hexabromocyclododecane. Helsinki, Finland. Retrieved from https://echa.europa.eu/registration-dossier/-/registered-dossier/15003/5/3/4#. HERO ID: 3970740					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by common name.	1	2	2
	2. Test Substance Purity	High	The test substance isomeric composition was reported from FTIR spectroscopy.	1	1	1
Test Design	3. Study Controls	High	Sterile soil and sludge control groups and blank (no HBCD added) control groups were reported.	1	2	2
	4. Test Substance Stability	High	Concentration and preparation of stock test solution was reported.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance. OECD Guideline 307 for aerobic and anaerobic transformation was followed.	1	1	1
	6. Testing Conditions	High	Testing conditions were reported and appropriate for the method.	1	2	2
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	High	System design was reported and appropriate.	1	1	1
Test Organisms	9. Test Organism Degradation	High	Inoculum source was reported.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study. The concentration of HBCD was measured with HPLC-MS. Degradation products were not detected in the soil or volatile phases at the end of the study.	1	1	1

	12. Sampling Methods	High	Sampling was frequent and long enough to observe the desired outcomes.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Standard deviation was reported for the extraction efficiency. No variables between the test groups were likely to have impacted the study results.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Target chemical concentration was reported as long as the absence of transformation products. Extraction efficiency was also reported.	1	2	2
	16. Statistical Methods and Kinetic Calculations	Medium	Kinetic calculations were not very clearly reported; however, this was unlikely to have impacted the study results.	2	1	2
Other	17. Verification or Plausibility of Results	Medium	No reference substances were used but the results were reasonable.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	17	20	22
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.1	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Le, TT; Son, MH; Nam, IH; Yoon, H; Kang, YG; Chang, YS. (2017). Transformation of hexabromocyclododecane in contaminated soil in association with microbial diversity. J Hazard Mater 325: 82-89. http://dx.doi.org/10.1016/j.jhazmat.2016.11.058. HERO ID: 3575047					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by common name.	1	2	2
	2. Test Substance Purity	High	The test substance purity was reported as the highest grade commercially available.	1	1	1
Test Design	3. Study Controls	High	Control experiments were performed using NaN3 treated soils.	1	2	2
	4. Test Substance Stability	High	The test substance stock solution preparation was reported.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	Testing conditions were reported and appropriate for the method.	1	2	2
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	High	System design was reported and appropriate. Closed system and low vapor pressure minimized chance of volatilization loss.	1	1	1
Test Organisms	9. Test Organism Degradation	High	Soil sources were reported. Population of microorganisms was also studied using PCR.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study. Residual HBCD concentration was measured in three combined 50/50 DCM/Hex extracts.	1	1	1

	12. Sampling Methods	High	Amount of soil taken for each sampling was not reported but was unlikely to have influenced the results. Samples were continuously shaken so the concentration of HBCD was likely homogenous throughout. Triplicate assays were also done.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	No confounding variables were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Transformation products were not identified; however, their omission was unlikely to have influenced the study results.	2	2	4
	16. Statistical Methods and Kinetic Calculations	High	Statistical method was defined for calculating residual concentrations.	1	1	1
Other	17. Verification or Plausibility of Results	High	Study results were reasonable although no ranges were defined using reference substances.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	20	22
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.1	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	**Le, TT; Son, MH; Nam, IH; Yoon, H; Kang, YG; Chang, YS. (2017). Transformation of hexabromocyclododecane in contaminated soil in association with microbial diversity. J Hazard Mater 325: 82-89. http://dx.doi.org/10.1016/j.jhazmat.2016.11.058.** **HERO ID: 3575047**					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by common name.	1	2	2

	2. Test Substance Purity	High	The test substance purity was reported as the highest grade commercially available.	1	1	1
Test Design	3. Study Controls	High	Control experiments were performed using NaN3 treated soils.	1	2	2
	4. Test Substance Stability	High	The test substance stock solution preparation was reported.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	Testing conditions were reported and appropriate for the method.	1	2	2
	7. Testing Consistency	High	No variables were noted between tests besides study length.	1	1	1
	8. System Type and Design	High	System design was reported and appropriate. Closed system and low vapor pressure minimized chance of volatilization loss.	1	1	1
Test Organisms	9. Test Organism Degradation	High	Soil sources were reported. Population of microorganisms was measured.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study. Residual HBCD concentration was measured in three combined 50/50 DCM/Hex extracts.	1	1	1
	12. Sampling Methods	High	Amount of soil taken for each sampling was not reported but was unlikely to have influenced the results. Samples were continuously shaken so the concentration of HBCD was likely homogenous throughout. Triplicate assays were also done so sampling error is accounted for.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	No confounding variables were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Data Presentation and Analysis	15. Data Reporting	Medium	Transformation products were not identified; however, their omission was unlikely to have influenced the study results.	2	2	4
	16. Statistical Methods and Kinetic Calculations	High	Statistical method was defined for calculating residual concentrations.	1	1	1
Other	17. Verification or Plausibility of Results	High	Study results were reasonable although no ranges were defined using reference substances.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	20	22
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.1	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Davis, JW; Gonsior, S; Marty, G; Ariano, J. (2005). The transformation of hexabromocyclododecane in aerobic and anaerobic soils and aquatic sediments. Water Res 39: 1075-1084. http://dx.doi.org/10.1016/j.watres.2004.11.024. HERO ID: 1443846					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source and purity were reported and confirmed by FTIR spectroscopy.	1	1	1
Test Design	3. Study Controls	Medium	Control groups were reported; however, long-term results were outside the range for strict validation of microbial degradation.	2	2	4
	4. Test Substance Stability	High	The test substance stability was included.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	Testing conditions were reported; OECD guideline referenced and appropriate for the method.	1	2	2
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	High	Guideline method was referenced for system design.	1	1	1
Test Organisms	9. Test Organism Degradation	High	Soil and activated sludge sources were reported.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study.	1	1	1
	12. Sampling Methods	High	The sampling was reported and suitable for the study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty were considered and accounted for in data evaluation.	1	1	1

	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study. Biotransformation half-lives were reported.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	Kinetic calculations were clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	20	22
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.1	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	ECHA (European Chemicals Agency). (2017). Biodegradation in soil: hexabromocyclododecane. Helsinki, Finland. Retrieved from https://echa.europa.eu/registration-dossier/-/registered-dossier/15003/5/3/4#. HERO ID: 3970740					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by common name.	1	2	2
	2. Test Substance Purity	High	The test substance isomeric composition was reported from FTIR spectroscopy.	1	1	1
Test Design	3. Study Controls	High	Sterile soil and sludge controls and blank (no HBCD added) controls were included in this study.	1	2	2
	4. Test Substance Stability	High	Concentration and preparation of stock test solution were reported.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance. OECD Guideline 307 for aerobic and anaerobic transformation was followed.	1	1	1
	6. Testing Conditions	High	Testing conditions were reported and appropriate for the method.	1	2	2
	7. Testing Consistency	High	No variables were noted between tests besides sampling days.	1	1	1
	8. System Type and Design	High	System design was reported and appropriate.	1	1	1
Test Organisms	9. Test Organism Degradation	High	Inoculum source was reported.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study. The concentration of HBCD was measured with HPLC-MS. Degradation products were not detected in the soil or volatile phases at the end of the study.	1	1	1

	12. Sampling Methods	High	Sampling was frequent and long enough to observe the desired outcomes.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Standard deviation was reported for the extraction efficiency. No variables between the test groups were likely to have impacted the study results.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Target chemical concentration was reported as well as the absence of transformation products. Extraction efficiency was also reported.	1	2	2
	16. Statistical Methods and Kinetic Calculations	Medium	Kinetic calculations were not very clearly reported; however, this was unlikely to have impacted the study results.	2	1	2
Other	17. Verification or Plausibility of Results	Medium	No reference substances were used but the results were reasonable.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	17	20	22
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.1	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	ACC (American Chemistry Council). (2005). HPV data summary and test plan for hexabromocyclododecane (HBCD). Arlington, VA: Brominated Flame Retardant Industry Panel (BFRIP), American Chemistry Council. http://www.epa.gov/oppt/chemrtk/pubs/summaries/cyclodod/c13459tc.htm. HERO ID: 1443881					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source was reported.	1	1	1
Test Design	3. Study Controls	High	A blank control group was included.	1	2	2
	4. Test Substance Stability	Low	The test substance preparation and storage conditions were not reported but their omission was unlikely to have impacted the study results.	3	1	3
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	2	4
	7. Testing Consistency	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
	8. System Type and Design	High	Guideline method was referenced.	1	1	1
Test Organisms	9. Test Organism Degradation	High	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
	12. Sampling Methods	High	The sampling was reported and suitable for the study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	No confounding variables were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	2	4
	16. Statistical Methods and Kinetic Calculations	High	Kinetic calculations were clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	22	20	29
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.45	**Overall Score (Rounded):**	1.5
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High[1]

[1]Primary reference (BFRIP, Dow, 2003 (Davis J, Gonsior S and Marty G. 2003. Evaluation of Aerobic and Anaerobic Transformation of Hexabromocyclododecane In Soil. Study Number 021082. Environmental Chemistry Research Laboratory. Toxicology & Environmental Research and Consulting. The Dow Chemical Company. Midland, MI)).

Study Reference:	U.S. EPA (U.S. Environmental Protection Agency). (2017). IUCLID data set: hexbromocyclododecane. Retrieved from https://java.epa.gov/oppt_chemical_search/. HERO ID: 3970216					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source and isomeric composition was reported.	1	1	1
Test Design	3. Study Controls	High	Abiotic control groups were included in this study.	1	2	2
	4. Test Substance Stability	Medium	The test substance preparation and storage conditions were not reported but their omission was unlikely to have impacted the study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	Medium	Some testing conditions (pH) were not provided; however, the omissions were not likely to have had a substantial impact on the study results.	2	2	4
	7. Testing Consistency	High	No variables were noted between tests besides sampling times.	1	1	1
	8. System Type and Design	Not rated	Not reported. This was a secondary source; the primary source may contain more detail.	NR	NR	NR
Test Organisms	9. Test Organism Degradation	High	Inoculum source was reported.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study. The concentration of HBCD was measured in the soil and the headspace was monitored for brominated transformation products.	1	1	1

	12. Sampling Methods	Medium	Some details regarding sample preparation for LC-MS were not reported but were not likely to have impacted the study results since OECD Test Guideline 307 was followed.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	No confounding variables were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Extraction efficiency and percent recovery were not reported; however, the reported HBCD decrease in controls of 3% and 1% suggest adequate recoveries were obtained during analysis.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Medium	Kinetic calculations were not clearly described but this was not likely to have impacted the results.	2	1	2
Other	17. Verification or Plausibility of Results	Medium	No reference substances were used; however, the results were reasonable.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	20	19	27
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.42	**Overall Score (Rounded):**	1.4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	U.S. EPA (U.S. Environmental Protection Agency). (2017). IUCLID data set: hexbromocyclododecane. Retrieved from https://java.epa.gov/oppt_chemical_search/. HERO ID: 3970216					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	The test substance purity was reported as commercial grade HBCD. Impurities, if any, were not likely to have impacted the study results.	2	1	2
Test Design	3. Study Controls	High	Abiotic control groups were included in this study.	1	2	2
	4. Test Substance Stability	Medium	The test substance preparation and storage conditions were not reported but their omission was unlikely to have impacted the study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	Medium	Some testing conditions (soil composition) were not provided; however, the omissions were not likely to have had a substantial impact on the study results.	2	2	4
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	Not rated	Not reported. This was a secondary source; the primary source may contain more detail.	NR	NR	NR
Test Organisms	9. Test Organism Degradation	High	Inoculum source was reported and is commonly used.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study.	1	1	1

	12. Sampling Methods	High	Limited detail reported in the secondary source; primary may contain more detail. Sampling details reported were appropriate.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	No confounding variables were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Transformation products and percent recovery were not reported; however, this was not likely to have impacted the study results.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Medium	Statistical methods and kinetic calculations were not clearly reported; however, their omission was not likely to have impacted the study results.	2	1	2
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	19	19	26
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.37	**Overall Score (Rounded):**	1.4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	U.S. EPA (U.S. Environmental Protection Agency). (2017). IUCLID data set: hexbromocyclododecane. Retrieved from https://java.epa.gov/oppt_chemical_search/. HERO ID: 3970216					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	The test substance purity was reported as commercial grade HBCD. Impurities, if any, were not likely to have impacted the study results.	2	1	2
Test Design	3. Study Controls	Medium	Controls were not reported. However, the use of radiolabeled HBCD reduces the chance of transformation products existing in the background.	2	2	4
	4. Test Substance Stability	Medium	The test substance preparation and storage conditions were not reported but their omission was unlikely to have impacted the study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	The test substance was added in nominal concentrations above its solubility so that transformation products could be identified.	1	1	1
	6. Testing Conditions	Low	Limited details were reported in this secondary source; however, the primary source may contain more detail. Since this is an IUCLID review, which gave the study a score of '(1): valid without restriction,' disqualifying the study did not seem appropriate.	3	2	6
	7. Testing Consistency	Medium	Testing conditions across groups were not reported as stated in metric 6, but a score of 4 was not given since the IUCLID report likely left out these details.	2	1	2
	8. System Type and Design	Not rated	Not reported. This was a secondary source; the primary source may contain more detail.	NR	NR	NR

Test Organisms	9. Test Organism Degradation	Low	Details regarding the inoculum source were not reported but were likely left out by the summary and the study should not be disqualified due to this.	3	2	6
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study.	1	1	1
	12. Sampling Methods	Low	Sampling methods were not described but were unlikely to have impacted the results.	3	1	3
Confounding / Variable Control	13. Confounding Variables	Medium	Differences between study groups or uncertainty in the measurements that would impact the study results were not noted.	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	The only result reported was the lack of degradation of HBCD.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Not rated	No statistical methods or kinetic calculations were reported.	NR	NR	NR
Other	17. Verification or Plausibility of Results	Medium	Limited details were reported in the secondary source; the primary source may contain more detail.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	26	18	37
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	2.06	**Overall Score (Rounded):**	2.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Low[1]

[1] This study's overall quality rating was downgraded: By itself this report provides very little information about the study. The high rating given to it by IUCLID suggests there is additional information that is not provided here, but without it this report may not be useful.

Study Reference:	ACC (American Chemistry Council). (2003). Hexabromocyclododecane (HBCD): An activated sludge, respiration inhibition test. (OTS: NA; 8EHQ Num: FYI-03-01472; DCN: 84040000010; TSCATS RefID: NA; CIS: FYI-03-01472). HERO ID: 4269929					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by common name.	1	2	2
	2. Test Substance Purity	High	The test substance source and isomeric composition were reported.	1	1	1
Test Design	3. Study Controls	High	A blank group was included in the study.	1	2	2
	4. Test Substance Stability	High	The test substance stability was included in this study.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	Testing conditions were reported and appropriate for the method.	1	2	2
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	Medium	Some deviations from the protocol were reported, but these were not likely to have impacted the result.	2	1	2
Test Organisms	9. Test Organism Degradation	High	Soil and activated sludge sources were reported.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study.	1	1	1
	12. Sampling Methods	High	The sampling was reported and suitable for the study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Concurrent controls for abiotic degradation allowed differentiation between biotic and abiotic degradation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study. HBCD concentrations were reported during the study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	The analysis of data was clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	20	21
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.05	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Davis, JW; Gonsior, S; Marty, G; Ariano, J. (2005). The transformation of hexabromocyclododecane in aerobic and anaerobic soils and aquatic sediments. Water Res 39: 1075-1084. http://dx.doi.org/10.1016/j.watres.2004.11.024. HERO ID: 1443846					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source and purity were reported and confirmed by FTIR spectroscopy.	1	1	1
Test Design	3. Study Controls	High	A concurrent control group was included.	1	2	2
	4. Test Substance Stability	High	The test substance stability was included.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	Testing conditions were reported; OECD guideline referenced and appropriate for the method.	1	2	2
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	High	Guideline method was referenced for system design.	1	1	1
Test Organisms	9. Test Organism Degradation	High	Soil and activated sludge sources were reported.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study.	1	1	1
	12. Sampling Methods	High	The sampling was reported and suitable for the study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty were considered and accounted for in data evaluation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study. Biotransformation half-lives were reported.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	Kinetic calculations were clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	15	20	20
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1	**Overall Score (Rounded):**	1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Hoh, E; Hites, RA. (2005). Brominated flame retardants in the atmosphere of the East-Central United States. Environ Sci Technol 39: 7794-7802. http://dx.doi.org/10.1021/es050718k. HERO ID: 999242					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Sources of test material used for analytical purposes were reported.	1	1	1
Test Design	3. Study Controls	High	Quality controls were included.	1	2	2
	4. Test Substance Stability	High	High temperature isomerization of HBCD was accounted for.	1	1	1
Test Conditions	5. Test Method Suitability	Low	Appropriate; however, the application of air-transport modeling was not applied/reported for HBCD.	3	1	3
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	Medium	The application of air- transport modeling was not applied/reported for HBCD.	2	1	2
	8. System Type and Design	Medium	Appropriate; however, the application of air-transport modeling was not applied/reported for HBCD.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	Medium	Appropriate; however, the application of air-transport modeling was not applied/reported for HBCD.	2	1	2
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding/ Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Some data were not reported, but omissions were unlikely to have substantially impacted the results.	2	2	4
	16. Statistical Methods and Kinetic	Medium	Some statistical method data were not reported, but omissions were unlikely to have substantially impacted the results.	2	1	2
Other	17. Verification or Plausibility of Results	Medium	The study results were reasonable; however, this was a monitoring study.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	22	18	27
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.5	**Overall Score (Rounded):**	1.7
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Medium[1]

[1]This study overall quality rating was downgraded: Air-transport modeling was not applied/reported for HBCD; however, informative data was reported on isomeric mixture in air.

Study Reference:	Zhou, DN; Chen, L; Wu, F; Wang, J; Yang, F. (2012). Debromination of hexabromocyclododecane in aqueous solutions by UV-C irradiation. Fresen Environ Bull 21: 107-111. HERO ID: 1106077					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance purity was reported.	1	1	1
Test Design	3. Study Controls	High	A control photolysis experiment was run using a UV-A lamp.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	Measurements were made twice with a reported error of less than 5%.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	Methodology considered multiple parameters.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

Confounding/ Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study. The study's aim was to consider multiple parameters related to this endpoint.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Most of the results were in the form of graphs, making quantitative interpretation impossible.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Medium	Most of the results were in the form of graphs, making quantitative interpretation impossible.	2	1	2
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	18	21
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.17	**Overall Score (Rounded):**	1.2
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Zhou, DN; Chen, L; Wu, F; Wang, J; Yang, F. (2012). Debromination of hexabromocyclododecane in aqueous solutions by UV-C irradiation. Fresen Environ Bull 21: 107-111. HERO ID: 1106077					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance purity was reported.	1	1	1
Test Design	3. Study Controls	High	A control photolysis experiment was run using a UV-A lamp.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	Measurements were made twice with a reported error of less than 5%.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	Methodology considered multiple parameters.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

Confounding/ Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study. The study's aim was to consider multiple parameters related to this endpoint.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Most of the results were in the form of graphs, making quantitative interpretation impossible.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Medium	Most of the results were in the form of graphs, making quantitative interpretation impossible.	2	1	2
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	18	21
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.17	**Overall Score (Rounded):**	1.2
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Zhou, DN; Chen, L; Wu, F; Wang, J; Yang, F. (2012). Debromination of hexabromocyclododecane in aqueous solutions by UV-C irradiation. Fresen Environ Bull 21: 107-111. HERO ID: 1106077					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance purity was reported.	1	1	1
Test Design	3. Study Controls	High	A control photolysis experiment was run using a UV-A lamp.	1	2	2
	4. Test Substance Stability	High	The control experiment indicated stability in aqueous media.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	Measurements were made twice with a reported error of less than 5%.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	Methodology considered multiple parameters.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding/ Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study. The study's aim was to consider multiple parameters related to this endpoint.	1	1	1

	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Most of the results were in the form of graphs, making quantitative interpretation impossible.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Medium	Most of the results were in the form of graphs, making quantitative interpretation impossible.	2	1	2
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	18	21
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.17	**Overall Score (Rounded):**	1.2
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Tomy, GT; Pleskach, K; Ferguson, SH; Hare, J; Stern, G; MacInnis, G; Marvin, CH; Loseto, L. (2009). Trophodynamics of some PFCs and BFRs in a western Canadian Arctic marine food web. Environ Sci Technol 43: 4076-4081. http://dx.doi.org/10.1021/es900162n. HERO ID: 1279130					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Sources of test material used for analytical purposes were reported.	1	1	1
Test Design	3. Study Controls	High	Quality assurance and controls were included and referenced to previous work.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding/ Variable	13. Confounding Variables	Not rated	No confounding variables were noted.	NR	NR	NR

Control	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study (with supplemental document)	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	13	18	18
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1	**Overall Score (Rounded):**	1.7
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Medium[1]
[1]This study's overall quality rating was downgraded: Not a designated/specific Fate endpoint; monitoring data field sampling data presented.						

Study Reference:	Klosterhaus, SL; Stapleton, HM; La Guardia, MJ; Greig, DJ. (2012). Brominated and chlorinated flame retardants in San Francisco Bay sediments and wildlife. Environ Int 47: 56-65. http://dx.doi.org/10.1016/j.envint.2012.06.005. HERO ID: 1443796					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The source of the test material was reported.	1	1	1
Test Design	3. Study Controls	High	Analytical controls/blanks were used.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study; monitoring study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	Medium	No definitive results nor analysis of data were conducted to evaluate the biomagnification factor quantitatively.	2	1	2
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

Confounding/ Variable Control	13. Confounding Variables	Medium	This was primarily a monitoring study.	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study; additional information can be obtained in supporting/supplemental data.	1	2	2
	16. Statistical Methods and Kinetic	High	The analysis of data was clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	17	20	22
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.1	**Overall Score (Rounded):**	1.7
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Medium[1]
[1]The study's overall quality rating was downgraded: Not a designated/specific Fate endpoint; monitoring study with a qualitative assessment of the results.						

Study Reference:	Zhao, YY; Zhang, XH; Sojinu, OS. (2010). Thermodynamics and photochemical properties of alpha, beta, and gamma-hexabromocyclododecanes: a theoretical study. Chemosphere 80: 150-156. http://dx.doi.org/10.1016/j.chemosphere.2010.04.002. HERO ID: 1443819					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Molecular modeling study where the isomer structures were optimized and consistent with experimental data.	1	1	1
Test Design	3. Study Controls	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	4. Test Substance Stability	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	Low	Appropriate; however, the UV wavelength employed did not represent aquatic environmental conditions.	3	2	6
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
come Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Confounding/ Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Appropriate; additional data in supplemental material.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
			Sum of scores:	14	15	19
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.27	**Overall Score (Rounded):**	1.7
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Medium[1]

[1]The study's overall quality rating was downgraded: This study provides sound results; however, the relevancy to photolysis under environmental conditions may be limited since the UV wavelength employed does not represent aquatic environmental conditions.

Study Reference:	Gerecke, AC; Giger, W; Hartmann, PC; Heeb, NV; Kohler, HP; Schmid, P; Zennegg, M; Kohler, M. (2006). Anaerobic degradation of brominated flame retardants in sewage sludge. Chemosphere 64: 311-317. http://dx.doi.org/10.1016/j.chemosphere.2005.12.016. HERO ID: 1443845					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source was reported.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Medium	Sampling timing was based on figure, not reported.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Low	Relative results were reported.	3	2	6
	16. Statistical Methods and Kinetic	Medium	Kinetic results were reported but calculations were not described.	2	1	2
Other	17. Verification or Plausibility of Results	Not rated	Due to limited information, evaluation of the reasonableness of the study results was not possible.	NR	NR	NR
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	18	19	25
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.32	**Overall Score (Rounded):**	1.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Gerecke, AC; Giger, W; Hartmann, PC; Heeb, NV; Kohler, HP; Schmid, P; Zennegg, M; Kohler, M. (2006). Anaerobic degradation of brominated flame retardants in sewage sludge. Chemosphere 64: 311-317. http://dx.doi.org/10.1016/j.chemosphere.2005.12.016. HERO ID: 1443845					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source was reported.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Medium	Sampling timing was based on figure, not reported.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Low	Relative results were reported.	3	2	6
	16. Statistical Methods and Kinetic	Medium	Kinetic results were reported but calculations were not described.	2	1	2
Other	17. Verification or Plausibility of Results	Not rated	Due to limited information, evaluation of the reasonableness of the study results was not possible.	NR	NR	NR
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	18	19	25
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.32	**Overall Score (Rounded):**	1.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Gerecke, AC; Giger, W; Hartmann, PC; Heeb, NV; Kohler, HP; Schmid, P; Zennegg, M; Kohler, M. (2006). Anaerobic degradation of brominated flame retardants in sewage sludge. Chemosphere 64: 311-317. http://dx.doi.org/10.1016/j.chemosphere.2005.12.016. HERO ID: 1443845					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source was reported.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Medium	Sampling timing was based on figure, not reported.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Low	Relative results were reported.	3	2	6
	16. Statistical Methods and Kinetic	Medium	Kinetic results were reported but calculations were not described.	2	1	2
Other	17. Verification or Plausibility of Results	Not rated	Due to limited information, evaluation of the reasonableness of the study results was not possible.	NR	NR	NR
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	18	19	25
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.32	**Overall Score (Rounded):**	1.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Gerecke, AC; Giger, W; Hartmann, PC; Heeb, NV; Kohler, HP; Schmid, P; Zennegg, M; Kohler, M. (2006). Anaerobic degradation of brominated flame retardants in sewage sludge. Chemosphere 64: 311-317. http://dx.doi.org/10.1016/j.chemosphere.2005.12.016. HERO ID: 1443845					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source and purity were reported.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	Testing conditions were monitored, reported, and appropriate for the method; based on a water solubility of 6.6x10-2 at 20 °C (EINECS 2008).	1	1	1
	6. Testing Conditions	Medium	Appropriate; however, primers were used to initiate anaerobic biodegradation.	2	2	4
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

	12. Sampling Methods	Medium	Sampling timing was based on figure, not reported in the study text.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	The target chemical and transformation product(s) concentrations were not reported.	2	2	4
	16. Statistical Methods and Kinetic	Medium	Kinetic results were reported but calculations were not described.	2	1	2
Other	17. Verification or Plausibility of Results	Not rated	Due to limited information, evaluation of the reasonableness of the study results was not possible.	NR	NR	NR
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	18	19	25
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.32	**Overall Score (Rounded):**	1.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Davis, JW; Gonsior, SJ; Markham, DA; Friederich, U; Hunziker, RW; Ariano, JM. (2006). Biodegradation and product identification of [14C]hexabromocyclododecane in wastewater sludge and freshwater aquatic sediment. Environ Sci Technol 40: 5395-5401. http://dx.doi.org/10.1021/es060009m. HERO ID: 1443842					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance purity and source were reported; non-radiolabeled confirmed by FTIR.	1	1	1
Test Design	3. Study Controls	Low	Reported results from abiotic control groups were outside the ranges specified for test validity.	3	2	6
	4. Test Substance Stability	Medium	Loss due to abiotic processes and/or adsorption were not controlled.	2	1	2
Test Conditions	5. Test Method Suitability	Medium	Loss due to abiotic processes and/or adsorption were not controlled.	2	1	2
	6. Testing Conditions	Medium	Some details were omitted.	2	2	4
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	Medium	Loss due to abiotic processes and/or adsorption were not controlled.	2	1	2
Test Organisms	9. Test Organism Degradation	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	Medium	Biodegradation was not confirmed, and specific rates were not reported.	2	1	2
	12. Sampling Methods	Medium	Some sampling details were omitted.	2	1	2

Confounding / Variable Control	13. Confounding Variables	High	There was appropriate discussion of possible loss scenarios; recovery was 63% of the initial radioactivity.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	23	20	31
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.55	**Overall Score (Rounded):**	1.6
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Davis, JW; Gonsior, SJ; Markham, DA; Friederich, U; Hunziker, RW; Ariano, JM. (2006). Biodegradation and product identification of [14C]hexabromocyclododecane in wastewater sludge and freshwater aquatic sediment. Environ Sci Technol 40: 5395- 5401. http://dx.doi.org/10.1021/es060009m. HERO ID: 1443842					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source and purity were reported; non-radiolabeled test substance identity was confirmed by FTIR.	1	1	1
Test Design	3. Study Controls	Low	Reported results from abiotic control groups were outside the ranges specified for test validity; however, this was briefly discussed (not confirmed).	3	2	6
	4. Test Substance Stability	Medium	Loss due to abiotic processes and/or adsorption were not controlled.	2	1	2
Test Conditions	5. Test Method Suitability	Medium	Loss due to abiotic processes and/or adsorption were not controlled.	2	1	2
	6. Testing Conditions	Medium	There were omissions in testing conditions; however, the omissions were not likely to have had a substantial impact on the study results.	2	2	4
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	Medium	Loss due to abiotic processes and/or adsorption were not controlled.	2	1	2
Test Organisms	9. Test Organism Degradation	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	Medium	Strict validation of biodegradation was not achieved.	2	1	2
	12. Sampling Methods	Medium	Some details were omitted; however, the omissions were unlikely to have hindered the interpretation of results.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	23	20	31
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.55	**Overall Score (Rounded):**	1.6
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Davis, JW; Gonsior, SJ; Markham, DA; Friederich, U; Hunziker, RW; Ariano, JM. (2006). Biodegradation and product identification of [14C]hexabromocyclododecane in wastewater sludge and freshwater aquatic sediment. Environ Sci Technol 40: 5395- 5401. http://dx.doi.org/10.1021/es060009m. HERO ID: 1443842					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source and purity were reported; non- radiolabeled test substance identity was confirmed by FTIR.	1	1	1
Test Design	3. Study Controls	Low	Reported results from abiotic control groups were outside the ranges specified for test validity; however, this was briefly discussed (not confirmed).	3	2	6
	4. Test Substance Stability	Medium	Loss due to abiotic processes and/or adsorption were not controlled.	2	1	2
Test Conditions	5. Test Method Suitability	Medium	Loss due to abiotic processes and/or adsorption were not controlled.	2	1	2
	6. Testing Conditions	Medium	There were omissions in testing conditions; however, the omissions were not likely to have had a substantial impact on the study results.	2	2	4
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	Medium	Loss due to abiotic processes and/or adsorption were not controlled in the system design.	2	1	2
Test Organisms	9. Test Organism Degradation	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	Low	Biodegradation was not confirmed, and specific rates were not reported; strict validation of biodegradation was not achieved.	3	1	3
	12. Sampling Methods	Medium	Some details were omitted; however, the omissions were unlikely to have hindered interpretation of results.	2	1	2
Confounding/ Variable Control	13. Confounding Variables	High	Appropriate discussion of possible loss scenarios.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Low	Initial concentration of test material in paragraph did not match the values reported in the tables.	3	2	6
	16. Statistical Methods and Kinetic Calculations	Medium	Some details were omitted; however, these omissions were not likely to have had a substantial impact on the study results.	2	1	2
Other	17. Verification or Plausibility of Results	Low	Unaccounted loss of radioactivity was noted in the abiotic controls.	3	1	3
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	29	20	39
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.95	**Overall Score (Rounded):**	2
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Medium

Study Reference:	Davis, JW; Gonsior, S; Marty, G; Ariano, J. (2005). The transformation of hexabromocyclododecane in aerobic and anaerobic soils and aquatic sediments. Water Res 39: 1075-1084. http://dx.doi.org/10.1016/j.watres.2004.11.024. HERO ID: 1443846					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance purity and source were reported; FTIR confirmation.	1	1	1
Test Design	3. Study Controls	Medium	Reported results from abiotic control groups were outside the ranges specified for test validity; however, this was discussed (not confirmed) and attributed to abiotic processes such as reductive dehalogenation.	2	2	4
	4. Test Substance Stability	Medium	Loss due to abiotic processes and/or adsorption did not appear to be controlled.	2	1	2
Test Conditions	5. Test Method Suitability	Medium	Strict validation of biodegradation was not achieved.	2	1	2
	6. Testing Conditions	High	Briefly described and OECD guideline referenced.	1	2	2
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	High	Guideline method was referenced.	1	1	1
Test Organisms	9. Test Organism Degradation	Medium	Details on the microbial population of the sediment system were not characterized.	2	2	4
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	Medium	Strict validation of biodegradation was not achieved.	2	1	2
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

Confounding / Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	Medium	Strict validation of biodegradation was not achieved; however, the results were discussed.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	21	20	28
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.4	**Overall Score (Rounded):**	1.4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Davis, JW; Gonsior, S; Marty, G; Ariano, J. (2005). The transformation of hexabromocyclododecane in aerobic and anaerobic soils and aquatic sediments. Water Res 39: 1075-1084. http://dx.doi.org/10.1016/j.watres.2004.11.024. HERO ID: 1443846					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance purity and source were reported; FTIR confirmation.	1	1	1
Test Design	3. Study Controls	Medium	Reported results from abiotic control groups were outside the ranges specified for test validity; however, this was discussed (not confirmed) and attributed to abiotic processes such as reductive dehalogenation.	2	2	4
	4. Test Substance Stability	Medium	Loss due to abiotic processes and/or adsorption did not appear to be controlled.	2	1	2
Test Conditions	5. Test Method Suitability	Medium	Strict validation of biodegradation was not achieved.	2	1	2
	6. Testing Conditions	High	Briefly described and OECD guideline referenced.	1	2	2
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	High	Guideline method was referenced.	1	1	1
Test Organisms	9. Test Organism Degradation	Medium	Details on the microbial population of the sediment system were not characterized.	2	2	4
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	Medium	Strict validation of biodegradation was not achieved.	2	1	2
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

Confounding / Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	Medium	Strict validation of biodegradation was not achieved; however, the results were discussed.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	21	20	28
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.4	**Overall Score (Rounded):**	1.4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Davis, JW; Gonsior, S; Marty, G; Ariano, J. (2005). The transformation of hexabromocyclododecane in aerobic and anaerobic soils and aquatic sediments. Water Res 39: 1075-1084. http://dx.doi.org/10.1016/j.watres.2004.11.024. HERO ID: 1443846					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance purity and source were reported; FTIR confirmation.	1	1	1
Test Design	3. Study Controls	Medium	Reported results from abiotic control groups were outside the ranges specified for test validity; however, this was discussed (not confirmed) and attributed to abiotic processes such as reductive dehalogenation.	2	2	4
	4. Test Substance Stability	Medium	Loss due to abiotic processes and/or adsorption did not appear to be controlled.	2	1	2
Test Conditions	5. Test Method Suitability	Medium	Strict validation of biodegradation was not achieved.	2	1	2
	6. Testing Conditions	High	Briefly described and OECD guideline referenced.	1	2	2
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	High	Guideline method was referenced.	1	1	1
Test Organisms	9. Test Organism Degradation	Medium	Details on the microbial population of the sediment system were not characterized.	2	2	4
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	Medium	Strict validation of biodegradation was not achieved.	2	1	2
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

Confounding / Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	Medium	Strict validation of biodegradation was not achieved; however, the results were discussed.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	21	20	28
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.4	**Overall Score (Rounded):**	1.4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Davis, JW; Gonsior, S; Marty, G; Ariano, J. (2005). The transformation of hexabromocyclododecane in aerobic and anaerobic soils and aquatic sediments. Water Res 39: 1075-1084. http://dx.doi.org/10.1016/j.watres.2004.11.024. HERO ID: 1443846					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance purity and source were reported; FTIR confirmation.	1	1	1
Test Design	3. Study Controls	Medium	Reported results from abiotic control groups were outside the ranges specified for test validity; however, this was discussed (not confirmed) and attributed to abiotic processes such as reductive dehalogenation.	2	2	4
	4. Test Substance Stability	Medium	Loss due to abiotic processes and/or adsorption did not appear to be controlled.	2	1	2
Test Conditions	5. Test Method Suitability	Medium	Strict validation of biodegradation was not achieved.	2	1	2
	6. Testing Conditions	High	Briefly described and OECD guideline referenced.	1	2	2
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	High	Guideline method was referenced.	1	1	1
Test Organisms	9. Test Organism Degradation	Medium	Details on the microbial population of the sediment system were not characterized.	2	2	4
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	Medium	Strict validation of biodegradation was not achieved.	2	1	2
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

Confounding / Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	Medium	Strict validation of biodegradation was not achieved; however, the results were discussed.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	21	20	28
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.4	**Overall Score (Rounded):**	1.4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	ACC (American Chemistry Council). (2005). HPV data summary and test plan for hexabromocyclododecane (HBCD). Arlington, VA: Brominated Flame Retardant Industry Panel (BFRIP), American Chemistry Council. http://www.epa.gov/oppt/chemrtk/pubs/summaries/cyclodod/c13459tc.htm. HERO ID: 1443881					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source was reported.	1	1	1
Test Design	3. Study Controls	Medium	Limited details regarding this metric; however, this source is a robust summary and a reference was provided.	2	2	4
	4. Test Substance Stability	Medium	No details regarding this metric; however, this was not likely to have had a substantial impact on the results.	2	1	2
Test Conditions	5. Test Method Suitability	Low	Details regarding this metric were omitted and the dosed concentration was above the reported water solubility for HBCD; however, this source is a robust summary and a reference was provided which may provide detail.	3	1	3
	6. Testing Conditions	Medium	Limited details regarding this metric; however, this source is a robust summary and a reference was provided.	2	2	4
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	Medium	Limited details regarding this metric; however, this source is a robust summary and a reference was provided.	2	1	2

Test Organisms	9. Test Organism Degradation	Medium	No details regarding source of microorganisms; however, this source is a robust summary and a reference was provided.	2	2	4
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	Medium	Details regarding this metric were omitted; however, this source is a robust summary and a reference was provided.	2	1	2
	12. Sampling Methods	Low	Information regarding this metric was not reported.	3	1	3
Confounding/ Variable Control	13. Confounding Variables	Not rated	No confounding variables were noted.	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Limited details were provided; however, this source is a robust summary and a reference was provided.	2	2	4
	16. Statistical Methods and Kinetic	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	High	The metric is not applicable to this study type.	1	1	1
			Sum of scores:	26	20	35
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.75	**Overall Score (Rounded):**	1.8
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Medium

Study Reference:	ACC (American Chemistry Council). (2005). HPV data summary and test plan for hexabromocyclododecane (HBCD). Arlington, VA: Brominated Flame Retardant Industry Panel (BFRIP), American Chemistry Council. http://www.epa.gov/oppt/chemrtk/pubs/summaries/cyclodod/c13459tc.htm. HERO ID: 1443881					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source was reported.	1	1	1
Test Design	3. Study Controls	Low	Details regarding this metric were omitted; however, this source is a robust summary and a routine OECD guideline was cited.	3	2	6
	4. Test Substance Stability	Medium	No details regarding this metric; however, this was not likely to have had a substantial impact on the results.	2	1	2
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	Low	Details regarding this metric were omitted; however, this source is a robust summary and a routine OECD guideline was cited.	3	2	6
	7. Testing Consistency	Not rated	Not applicable; multiple study groups were not reported.	NR	NR	NR
	8. System Type and Design	Medium	Details regarding this metric were omitted; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
Test Organisms	9. Test Organism Degradation	Low	Details regarding this metric were omitted; however, this source is a robust summary and a routine OECD guideline was cited.	3	2	6
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	Low	Details regarding this metric were omitted; however, this source is a robust summary and a routine OECD guideline was cited.	3	1	3
	12. Sampling Methods	Low	Details regarding this metric were omitted; however, this source is a robust summary and a routine OECD guideline was cited.	3	1	3
Confounding / Variable Control	13. Confounding Variables	Not rated	No confounding variables were noted.	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Low	Details regarding this metric were omitted; however, this source is a robust summary and a routine OECD guideline was cited.	3	2	6
	16. Statistical Methods and Kinetic	Not rated	Not reported; secondary source; the primary source may have more detail.	NR	NR	NR
Other	17. Verification or Plausibility of Results	Medium	Details regarding this metric were omitted; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	27	17	40
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	2.35	**Overall Score (Rounded):**	2.2
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Medium

Study Reference:	ACC (American Chemistry Council). (2005). HPV data summary and test plan for hexabromocyclododecane (HBCD). Arlington, VA: Brominated Flame Retardant Industry Panel (BFRIP), American Chemistry Council. http://www.epa.gov/oppt/chemrtk/pubs/summaries/cyclodod/c13459tc.htm. HERO ID: 1443881					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source was reported.	1	1	1
Test Design	3. Study Controls	Low	Details regarding this metric were omitted; however, this source is a robust summary and routine guidelines were cited.	3	2	6
	4. Test Substance Stability	Medium	Details regarding this metric were omitted; however, this was not likely to have had a substantial impact on the results.	2	1	2
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study; multiple guidelines cited.	1	1	1
	6. Testing Conditions	Medium	Limited details were reported; however, this source is a robust summary and routine guidelines were cited.	2	2	4
	7. Testing Consistency	Medium	Details regarding this metric were omitted; however, this source is a robust summary and routine guidelines were cited.	2	1	2
	8. System Type and Design	Medium	Details regarding this metric were omitted; however, this source is a robust summary and routine guidelines were cited.	2	1	2

Test Organisms	9. Test Organism Degradation	Medium	Details regarding this metric were limited; however, this source is a robust summary and routine guidelines were cited.	2	2	4
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	Low	Details regarding this metric were omitted; however, this source is a robust summary and routine guidelines were cited.	3	1	3
	12. Sampling Methods	Low	Details regarding this metric were omitted; however, this source is a robust summary and routine guidelines were cited.	3	1	3
Confounding / Variable Control	13. Confounding Variables	Medium	Details regarding this metric were limited; however, this source is a robust summary and routine guidelines were cited.	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Low	Details regarding this metric were limited; however, this source is a robust summary and routine guidelines were cited.	3	2	6
	16. Statistical Methods and Kinetic	Low	Details regarding this metric were omitted; however, this source is a robust summary and routine guidelines were cited.	3	1	3
Other	17. Verification or Plausibility of Results	Medium	Details regarding this metric were limited; however, this source is a robust summary and routine guidelines were cited.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	32	20	43

High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	2.15	**Overall Score (Rounded):**	2.2
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Medium

Study Reference:	ACC (American Chemistry Council). (2005). HPV data summary and test plan for hexabromocyclododecane (HBCD). Arlington, VA: Brominated Flame Retardant Industry Panel (BFRIP), American Chemistry Council. http://www.epa.gov/oppt/chemrtk/pubs/summaries/cyclodod/c13459tc.htm. HERO ID: 1443881					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source was reported.	1	1	1
Test Design	3. Study Controls	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	2	4
	4. Test Substance Stability	Low	Details regarding this metric were omitted; however, this was not likely to have had a substantial impact on the results.	3	1	3
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	2	4
	7. Testing Consistency	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	2	4

	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
	12. Sampling Methods	Low	Details regarding this metric were omitted; however, this source is a robust summary and a routine OECD guideline was cited.	3	1	3
Confounding / Variable Control	13. Confounding Variables	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
Other	17. Verification or Plausibility of Results	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	28	20	37
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.85	**Overall Score (Rounded):**	1.6
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High[1]

[1]The study's overall quality rating was upgraded: This is a secondary source; however, it is a robust summary with a routine OECD guideline and primary references were cited (BFRIP and Davis et al., Evaluation of Aerobic and Anaerobic Transformation of Hexabromocyclododecane In Aquatic Sediment Systems. Study Number 021081. Environmental Chemistry Research Laboratory, Toxicology & Environmental Research and Consulting. The Dow Chemical Company Midland, Michigan. (2003)).

Study Reference:	Hu, J; Jin, J; Wang, Y; Ma, Z; Zheng, W. (2011). Levels of polybrominated diphenyl ethers and hexabromocyclododecane in the atmosphere and tree bark from Beijing, China. Chemosphere 84: 355-360. http://dx.doi.org/10.1016/j.chemosphere.2011.04.002 HERO ID: 1927637					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source was reported.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study; analytical blanks did not have target chemicals.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	Medium	Ambient conditions during sampling were not defined.	2	2	4
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Low	The test organism was not routinely used for similar study types.	3	2	6
Outcome Assessment	11. Outcome Assessment Methodology	Medium	Isomer specific results from concentrations of total HBCD.	2	1	2
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

Confounding/ Variable Control	13. Confounding Variables	Not rated	No confounding variables were noted.	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Low	Concentrations of the individual isomers were not reported, preventing meaningful interpretation of the isomeric specific calculations.	3	2	6
	16. Statistical Methods and Kinetic	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	Low	Limited data regarding this metric made it difficult to confirm the validity of the estimated values for the individual isomers as concentrations of HBCD were for total HBCD.	3	1	3
	18. QSAR Models	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
			Sum of scores:	23	20	33
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.65	**Overall Score (Rounded):**	3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Low[1]

[1]The study's overall quality rating was downgraded: Study does not lend new insight or valid data to an existing model. Studies that apply an existing model to a specific site/situation should be excluded unless it's also presented alongside new data. Could be considered for monitoring data.

Study Reference:	Hermanson, MH; Isaksson, E; Forsström, S; Teixeira, C; Muir, DC; Pohjola, VA; van de Wal, RS. (2010). Deposition history of brominated flame retardant compounds in an ice core from Holtedahlfonna, Svalbard, Norway. Environ Sci Technol 44: 7405-7410. http://dx.doi.org/10.1021/es1016608. HERO ID: 1927665					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	The test substance was identified by analytical means. Source and purity of analytical standards were not reported.	2	1	2
Test Design	3. Study Controls	High	The study did not require concurrent control groups; analytical blanks and contamination were assessed.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study; field monitoring.	1	1	1
	6. Testing Conditions	Medium	Limited detail on the characterization/relevance of the site.	2	2	4
	7. Testing Consistency	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	8. System Type and Design	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	Low	Definitive atmospheric deposition was not confirmed/analyzed; study modeled air trajectories and measured concentrations in ice, but other environmental media were not assessed.	3	1	3
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding/ Variable Control	13. Confounding Variables	Not rated	No confounding variables were noted.	NR	NR	NR

	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Analytical method did not account for isomerization above 160 °C; therefore, quantified results were reported as total HBCD due to thermal isomerization; however, this was not likely to have had a substantial impact on the interpretation of the reported study results.	2	2	4
	16. Statistical Methods and Kinetic	High	The analysis of data was clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Medium	Due to limited information, assessment of the air trajectory model was not possible; however, this was not a QSAR and not directly related to quantifiable results.	2	1	2
			Sum of scores:	18	16	24
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.5	**Overall Score (Rounded):**	1.7
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Medium
The study's overall quality rating was downgraded: Study results not relevant to a specific/designated Fate endpoint.						

Study Reference:	Haukås, M; Mariussen, E; Ruus, A; Tollefsen, KE. (2009). Accumulation and disposition of hexabromocyclododecane (HBCD) in juvenile rainbow trout (Oncorhynchus mykiss). Aquat Toxicol 95: 144-151. http://dx.doi.org/10.1016/j.aquatox.2009.08.010. HERO ID: 1927701					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source and purity were reported.	1	1	1
Test Design	3. Study Controls	High	Study employed a negative control group of organisms appropriately.	1	2	2
	4. Test Substance Stability	Low	Dilution steps during food preparation and administration likely influenced the concentration of the test substance and may have led to uncertainty in analytical measurements; stability of test material in feed was not reported.	3	1	3
Test Conditions	5. Test Method Suitability	High	Test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	Medium	Feed was not well characterized. However, water flow, temperature, pH, and oxygen content were monitored.	2	2	4
	7. Testing Consistency	High	Test conditions were consistent across sample groups.	1	1	1
	8. System Type and Design	High	System design was appropriate for maintaining exposure concentrations during the study period.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR

	10. Test Organism Partitioning	High	Information was provided regarding the test organisms, including source, fork length and body weight. Organisms were acclimated appropriately before test initiation.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	Unacceptable	The assessment methodology did not address or report bioaccumulation factors. Rather, accumulation was loosely described as the measured concentrations in fish over time.	4	1	4
	12. Sampling Methods	High	No notable uncertainties or limitations were expected to influence results.	1	1	1
Confounding/ Variable Control	13. Confounding Variables	Medium	Fish were not fed after exposure; this may have affected the rate of elimination.	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Unacceptable	LODs for specific isomers were reported as ranges; d-18-γ-HBCD used for internal standard for β-HBCD measurements may have led to uncertainties in the initial food measurements and during experimental analysis, an increasing trend was evident but could not be strictly quantified; the analytical method may not have been suitable for meaningful detection of the test substance.	4	2	8
	16. Statistical Methods and Kinetic	High	Statistical methods were clearly described and addressed the data collected.	1	1	1
Other	17. Verification or Plausibility of Results	Low	Due to limited information, evaluation of the reasonableness of the study results was not possible.	3	1	3
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR

			Sum of scores:	27	20	36
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.8	**Overall Score (Rounded):**	4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Unacceptable[1]

[1]BCF not reported. Disposition data may be useful to other disciplines; however, the analytical method may not be suitable for meaningful detection of the test substance. Consistent with our Application of Systematic Review in TSCA Risk Evaluations document, if a metric for a data source receives a score of Unacceptable (score = 4), EPA will determine the study to be unacceptable. In this case, two of the metrics were rated as unacceptable. As such, the study is considered unacceptable and the score is presented solely to increase transparency.

Study Reference:	**Harrad, S; Abdallah, MA; Covaci, A. (2009). Causes of variability in concentrations and diastereomer patterns of hexabromocyclododecanes in indoor dust. Environ Int 35: 573-579.** http://dx.doi.org/10.1016/j.envint.2008.10.005**.** **HERO ID: 1927725**					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	The test substance purity and source were not reported; however, the omissions were not likely to have had a substantial impact on the study results	2	1	2
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding/ Variable Control	13. Confounding Variables	High	No confounding differences between the study groups were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	15	18	19
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.06	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	**Ichihara, M; Yamamoto, A; Takakura, K; Kakutani, N; Sudo, M. (2014). Distribution and pollutant load of hexabromocyclododecane (HBCD) in sewage treatment plants and water from Japanese Rivers. Chemosphere 110: 78-84.** http://dx.doi.org/10.1016/j.chemosphere.2014.03.074**.** **HERO ID: 2343678**					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means.	1	1	1
Test Design	3. Study Controls	Medium	Analytical controls/blanks were not reported.	2	2	4
	4. Test Substance Stability	Medium	Analytical procedures did not discuss/account for possible thermal isomerization; however, total HBCD concentrations were reported; therefore, this was not considered a serious flaw.	2	1	2
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	Medium	Sewage sludge samples were not assessed to account for loss of material.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	Appropriate for a general screening of STP removal.	1	1	1
	12. Sampling Methods	Medium	This metric met the criteria for high confidence as expected for this type of study.	2	1	2

Confounding/ Variable Control	13. Confounding Variables	Not rated	No confounding variables were noted.	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic	Medium	Some calculations were not reported, but omissions were unlikely to have substantially impacted the results.	2	1	0
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	17	14	19
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.36	**Overall Score (Rounded):**	1.4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Takigami, H; Watanabe, M; Kajiwara, N. (2014). Destruction behavior of hexabromocyclododecanes during incineration of solid waste containing expanded and extruded polystyrene insulation foams. Chemosphere 116: 24-33. http://dx.doi.org/10.1016/j.chemosphere.2014.01.082. HERO ID: 2343703					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means.	1	1	1
Test Design	3. Study Controls	Medium	A baseline experiment was included; however, analytical blanks were not reported.	2	2	4
	4. Test Substance Stability	Medium	Thermal isomerization of individual isomers was not discussed; however, this omission did not greatly flaw the overall results.	2	1	2
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	Medium	Flow rate for the baseline experiment was greater; however, this was not likely to have influenced the results.	2	1	2
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding/ Variable Control	13. Confounding Variables	Medium	This was a pilot-study; scale-up and long-term experiments were necessary.	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Some information was not reported; however, these omissions were not likely to have had a substantial impact on the study results.	2	2	4
	16. Statistical Methods and Kinetic	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	19	18	25
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.39	**Overall Score (Rounded):**	1.4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Zhou, D; Wu, Y; Feng, X; Chen, Y; Wang, Z; Tao, T; Wei, D. (2014). Photodegradation of hexabromocyclododecane (HBCD) by Fe(III) complexes/H2O 2 under simulated sunlight. Environ Sci Pollut Res Int 21: 6228-6233. http://dx.doi.org/10.1007/s11356- 014-2553-0. HERO ID: 2343710					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source and purity were reported.	1	1	1
Test Design	3. Study Controls	Not rated	Controls were not required to interpret the study results.	NR	NR	NR
	4. Test Substance Stability	High	Solutions were freshly prepared.	1	1	1
Test Conditions	5. Test Method Suitability	Medium	The test substance concentration was not reported (but available in the supplementary information).	2	1	2
	6. Testing Conditions	Medium	There were omissions in the test condition reporting (temperature, intensity).	2	2	4
	7. Testing Consistency	High	Rate constant studies were performed in triplicate for three systems in a consistent manner	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	Appropriate method for a photodegradation study.	1	1	1
	12. Sampling Methods	Low	Sample timing details were not reported.	3	1	3
Confounding/ Variable Control	13. Confounding Variables	High	Pyrex tubes were used to eliminate UV-wavelengths; it was established that the active species were hydroxy radicals.	1	1	1

	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Graphed data of various conditions included but concentrations and % recovery not reported; the omissions were not likely to have had a substantial impact on study results.	1	2	2
	16. Statistical Methods and Kinetic Calculations	Not rated	Not reported but not required to interpret results.	NR	NR	NR
Other	17. Verification or Plausibility of Results	High	Results were reasonable (did not photodegrade after unknown time period - likely 200 min).	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	15	20
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.33	**Overall Score (Rounded):**	1.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Arinaitwe, K; Muir, DC; Kiremire, BT; Fellin, P; Li, H; Teixeira, C. (2014). Polybrominated diphenyl ethers and alternative flame retardants in air and precipitation samples from the northern Lake Victoria region, East Africa. Environ Sci Technol 48: 1458-1466. http://dx.doi.org/10.1021/es403600a. HERO ID: 2343716					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding/ Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic	High	Statistical methods were reported; kinetic calculations were not made.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	14	18	18
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1	**Overall Score (Rounded):**	1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Zhang, Y; Sun, H; Liu, F; Dai, Y; Qin, X; Ruan, Y; Zhao, L; Gan, Z. (2013). Hexabromocyclododecanes in limnic and marine organisms and terrestrial plants from Tianjin, China: diastereomer- and enantiomer-specific profiles, biomagnification, and human exposure. Chemosphere 93: 1561-1568. http://dx.doi.org/10.1016/j.chemosphere.2013.08.004. HERO ID: 2343741					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Source and purity of chemicals were reported.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	No omissions about the testing conditions were likely to have impacted the study results.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	Test species were clearly reported and have been used in other studies, which were cited as references for the results.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	Diastereomeric profiles and trophic magnification factors can be appropriately reported using this assessment methodology.	1	1	1

	12. Sampling Methods	High	No sampling limitations were noted that would have influenced the study results.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Sources of variability and uncertainty were addressed using triplicate analysis and internal standards. No confounding differences between study groups were noted.	1	1	1
	14. Outcomes Unrelated to Exposure	High	No differences in attrition between organisms were reported.	1	1	1
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	Results were reasonable and were compared to the results of other similar studies.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	21	21
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1	**Overall Score (Rounded):**	1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Schreder, ED; La Guardia, MJ. (2014). Flame retardant transfers from U.S. households (dust and laundry wastewater) to the aquatic environment. Environ Sci Technol 48: 11575-11583. http://dx.doi.org/10.1021/es502227h. HERO ID: 2528320					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding/ Variable	13. Confounding Variables	Not rated	No confounding variables were noted.	NR	NR	NR

Control	14. Outcomes Unrelated to Exposure	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	Medium	Some details were omitted; however, these omissions were not likely to have had a substantial impact on the study results.	2	1	2
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	15	18	19
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.06	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Rauert, C; Harrad, S; Stranger, M; Lazarov, B. (2014). Test chamber investigation of the volatilization from source materials of brominated flame retardants and their subsequent deposition to indoor dust. Indoor Air 25: 393-404. http://dx.doi.org/10.1111/ina.12151. HERO ID: 2528329					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	Medium	Equilibrium was not established preventing quantifiable assessment of partitioning.	2	1	3
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	Low	This study was an indicator of the importance of sink effects when studying migration to dust since steady state was not achieved due to limited study time.	3	1	3

	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding/ Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	17	18	22
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.22	**Overall Score (Rounded):**	1.7
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Medium[1]
[1]The study's overall quality rating was downgraded: Overall this test is an indicator of the importance of sink effects when studying migration to dust since steady state was not achieved due to limited study time.						

Study Reference:	Bradshaw, C; Strid, A; von Stedingk, H; Gustafsson, K. (2015). Effects of benthos, temperature, and dose on the fate of hexabromocyclododecane in experimental coastal ecosystems. Environ Toxicol Chem 34: 1246-1257. http://dx.doi.org/10.1002/etc.2947. HERO ID: 3013490					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2

Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding/ Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Data Presentation and Analysis	15. Data Reporting	Medium	Extraction efficiency was not reported but was unlikely to have impacted the study results.	2	2	4
	16. Statistical Methods and Kinetic	High	Statistical analysis was clearly defined.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	17	21	23
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.1	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Bradshaw, C; Strid, A; von Stedingk, H; Gustafsson, K. (2015). Effects of benthos, temperature, and dose on the fate of hexabromocyclododecane in experimental coastal ecosystems. Environ Toxicol Chem 34: 1246-1257. http://dx.doi.org/10.1002/etc.2947. HERO ID: 3013490					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source and purity were reported.	1	1	1
Test Design	3. Study Controls	Medium	Controls were included in the study; however, control results were not reported.	2	2	4
	4. Test Substance Stability	Low	Nominal concentration above the water solubility of HBCD.	3	1	3
Test Conditions	5. Test Method Suitability	Medium	Field water was not examined prior to experiment; field blanks were not reported.	2	1	2
	6. Testing Conditions	Unacceptable	Temperature was not reported or monitored (may be included in SI); this was a serious flaw that hindered the interpretation of the results based on HBCD behavior with respect to temperature.	4	2	8
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	Medium	Limited details hindered the interpretation of the results.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	Unacceptable	Analytical details were not included; no quantitative partitioning was reported; thermal isomerization cannot be ruled out; precise evaluation of the results was not possible; the supplementary data were not readily available	4	1	4
	12. Sampling Methods	Low	Not reported.	3	1	3
Confounding/ Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Low	Some details were omitted, and supplemental data were not readily available.	3	2	6
	16. Statistical Methods and Kinetic	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	Low	Quantitative results on partitioning were not provided.	3	1	3
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	31	18	41
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	2.28	**Overall Score (Rounded):**	4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Unacceptable[1]

[1]Analytical details were not included. Supplemental data should be evaluated for a more thorough assessment. Consistent with our Application of Systematic Review in TSCA Risk Evaluations document, if a metric for a data source receives a score of Unacceptable (score = 4), EPA will determine the study to be unacceptable. In this case, two of the metrics were rated as unacceptable. As such, the study is considered unacceptable and the score is presented solely to increase transparency.

Study Reference:	Lee, SC; Sverko, E; Harner, T; Pozo, K; Barresi, E; Schachtschneider, J; Zaruk, D; Dejong, M; Narayan, J. (2016). Retrospective analysis of "new" flame retardants in the global atmosphere under the GAPS Network. Environ Pollut 217: 62-69. http://dx.doi.org/10.1016/j.envpol.2016.01.080. HERO ID: 3350487					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source and purity was reported.	1	1	1
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	Medium	Samples were extracted in 2005- 2006 but analyzed for this study in 2009. The authors assumed that the integrity of the samples was maintained during that time but also acknowledged that further study should be done in the future regarding that issue. This most likely did not have an impact on the study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding/ Variable Control	13. Confounding Variables	High	The inconsistency of wind speed during sampling times was one factor that changed between study groups; however, this was discussed by the authors and accounted for by the use of depuration standards.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	15	18	19
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.06	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Zhu, H; Sun, H; Zhang, Y; Xu, J; Li, B; Zhou, Q. (2016). Uptake pathway, translocation, and isomerization of hexabromocyclododecane diastereoisomers by wheat in closed chambers. Environ Sci Technol 50: 2652-2659. http://dx.doi.org/10.1021/acs.est.5b05118. HERO ID: 3350492					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	Reagent details were given in the supplemental information but not in the study. Impurity effects were unlikely to have influenced the study results.	2	1	2
Test Design	3. Study Controls	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding/ Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	High	No organism attrition was noted between study groups.	1	1	1
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic	Medium	Calculations were not clearly described in this study, but supplemental information was cited that contained more tables and equations so the omission in the study was unlikely to have impacted the study results.	2	1	2
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	18	21	23
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.1	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Stiborova, H; Vrkoslavova, J; Pulkrabova, J; Poustka, J; Hajslova, J; Demnerova, K. (2015). Dynamics of brominated flame retardants removal in contaminated wastewater sewage sludge under anaerobic conditions. Sci Total Environ 533: 439-445. http://dx.doi.org/10.1016/j.scitotenv.2015.06.131. HERO ID: 3350527					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance source and purity were reported.	1	1	1
Test Design	3. Study Controls	High	Steam sterilized sludge was used as the abiotic control.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	Medium	The pH and temperature were not reported; however, their omission was unlikely to have impacted the study results.	2	2	4
	7. Testing Consistency	High	No differences were noted among sample groups. Each sample was also done in triplicate, which reduced variability inside sample groups.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	High	The inoculum sources were reported.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	Low	Actual data were in supplementary data; no quantifiable answer was reported.	3	1	3

	12. Sampling Methods	Low	Sampling began after HBCD concentrations had already decreased to below detectable levels.	3	1	3
Confounding / Variable Control	13. Confounding Variables	Medium	Although the authors stated that the loss of HBCD was due to microbial degradation, the data were only presented in the supplementary material.	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	Transformation products were not reported but were unlikely to have impacted the study results. Sufficient testing was done to show that sorption did not impact the study results.	2	2	4
	16. Statistical Methods and Kinetic Calculations	High	Statistical methods were clearly outlined.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	22	20	29
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.45	**Overall Score (Rounded):**	1.5
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Kim, UJ; Lee, IS; Oh, JE. (2016). Occurrence, removal and release characteristics of dissolved brominated flame retardants and their potential metabolites in various kinds of wastewater. Environ Pollut 218: 551-557. http://dx.doi.org/10.1016/j.envpol.2016.07.037. HERO ID: 3545985					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means.	1	1	1
Test Design	3. Study Controls	Medium	Control groups were not used by this was not likely to have affected the study results	2	2	4
	4. Test Substance Stability	High	Detailed procedure presents no issues involving preparation and process of test samples.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	Medium	Testing controls were not reported in depth for each treatment plant; however, the types of treatment used and sewage sources at each plant were given so study results were useful.	2	2	4
	7. Testing Consistency	High	Differences between treatment plants and any sampling or processing were reported.	1	1	1
	8. System Type and Design	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Organisms	9. Test Organism Degradation	High	Inoculum sources were reported for all test groups.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	The concentration of HBCD in the effluent and influent of the treatment plants was an appropriate outcome to monitor.	1	1	1

	12. Sampling Methods	Medium	Composite samples were said to be taken over a 24-48-hour period; however, whether this was a continuous sampling or done in intervals is unknown; unlikely to have substantially impacted study results.	2	1	2
Confounding/ Variable Control	13. Confounding Variables	Medium	Sources of uncertainty between study groups were not noted; however, this was unlikely to have impacted the study results as overall removal percentages were investigated, and treatments were not being compared directly to one another.	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Analytical method was suitable for identifying and quantifying the parent compound.	1	2	2
	16. Statistical Methods and Kinetic	High	Simple kinetic calculations based on the concentration of the parent compound in the influent and effluent were made.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	19	20	26
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.3	**Overall Score (Rounded):**	1.7
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Medium[1]
[1]The study's overall quality rating was downgraded: Study results not relevant to a specific/designated Fate endpoint.						

Study Reference:	Barontini, F; Cozzani, V; Petarca, L. (2001). Thermal stability and decomposition products of hexabromocyclododecane. Ind Eng Chem Res 40: 3270-3280. http://dx.doi.org/10.1021/ie001002v. HERO ID: 3575301					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means.	1	1	1
Test Design	3. Study Controls	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	4. Test Substance Stability	High	The test substance stability was evaluated.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	Test conditions were consistent across samples or study groups.	1	1	1
	8. System Type and Design	High	The system type and design were adequate for the study.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

Confounding/ Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	13	16	16
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1	**Overall Score (Rounded):**	1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	ECHA (European Chemicals Agency). (2017). Biodegradation in water: screening tests: hexabromocyclododecane. Helsinki, Finland. Retrieved from https://echa.europa.eu/registration-dossier/-/registered-dossier/15003/5/3/2#. HERO ID: 3970739					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by common name and CASRN.	1	2	2
	2. Test Substance Purity	High	The test substance source and purity were reported.	1	1	1
Test Design	3. Study Controls	High	Toxicity and biologically inhibited controls were used.	1	2	2
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	Medium	HBCD was tested at a concentration a degree of magnitude higher than its aqueous solubility so that [14C]products of transformation would be identifiable.	2	1	2
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	High	Equilibrium was established and the samples were constantly stirred throughout testing.	1	1	1
Test Organisms	9. Test Organism Degradation	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	Low	Limited details were reported in the secondary source; the primary source may contain more detail. Standard deviations were not reported for any results.	3	1	3
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	HBCD and transformation product concentrations were reported along with extraction efficiency of method spikes.	1	2	2
	16. Statistical Methods and Kinetic	Medium	Limited kinetic calculations were done and were not reported clearly. However, this did not likely have had a substantial impact on the results.	2	1	2
Other	17. Verification or Plausibility of Results	Medium	The study results were reasonable, but no range was defined by a reference substance in the results.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	20	20	25
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.25	**Overall Score (Rounded):**	1.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Jenssen, B; Sormo, E; Salmer, M; Baek, K; Skaare, J. (2004). Brominated flame retardants (BFRs) in the Arctic marine food chain. Third International Workshop on Brominated Flame Retardants. HERO ID: 4140373					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means.	1	1	1
Test Design	3. Study Controls	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	Low	No details were provided regarding the sampling, work-up, or analytical techniques.	3	1	3
	6. Testing Conditions	Unacceptable	Sampling dates and storage conditions were not reported.	4	2	8
	7. Testing Consistency	Unacceptable	No details on sampling or storage were provided.	4	1	4
	8. System Type and Design	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Low	The test organism is not routinely used for similar study types.	3	2	6
Outcome Assessment	11. Outcome Assessment Methodology	Unacceptable	Details on methodology were not provided.	4	1	4
	12. Sampling Methods	Low	Only the sampling location was provided; all other data, such as dates and storage conditions, were not provided.	3	1	3

Confounding/ Variable Control	13. Confounding Variables	Unacceptable	Tissue types were not reported.	4	1	4
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Unacceptable	Number of samples of each species was not reported.	4	2	8
	16. Statistical Methods and Kinetic	Low	Standard deviations were not reported.	3	1	3
Other	17. Verification or Plausibility of Results	Unacceptable	Not enough details in the sample types to verify the results as plausible.	4	1	4
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	39	17	51
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	3	**Overall Score (Rounded):**	4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Unacceptable[1]

[1]Study results not relevant to a specific/designated Fate endpoint. Limited details reported (i.e., no details were provided regarding the sampling, work-up, or analytical techniques). Consistent with our Application of Systematic Review in TSCA Risk Evaluations document, if a metric for a data source receives a score of Unacceptable (score = 4), EPA will determine the study to be unacceptable. In this case, six of the metrics were rated as unacceptable. As such, the study is considered unacceptable and the score is presented solely to increase transparency.

Study Reference:	Leonards, P; Vethaak, D; Brandsma, S; Kwadijk, C; Micic, D; Jol, J; Schout, P; de Boer, J. (2004). Species specific accumulation and biotransformation of polybrominated diphenyl ethers and hexabromocyclododecane in two Dutch food chains. Third International Workshop on Brominated Flame Retardants. HERO ID: 4140495					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means.	1	1	1
Test Design	3. Study Controls	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	4. Test Substance Stability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Test Conditions	5. Test Method Suitability	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	6. Testing Conditions	Medium	Some details were missing, but this was not likely to have affected the interpretation of the result.	2	2	4
	7. Testing Consistency	Medium	Some study details were not reported; however, these omissions were not likely to have affected the interpretation of the result.	2	1	2
	8. System Type and Design	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Medium	Details on storage conditions were not provided.	2	1	2

Confounding/ Variable Control	13. Confounding Variables	Medium	As reported, the cause of distribution of the isomers was not discernable.	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Low	Only a graph of the results was provided; numerical results were not reported. Results were only reported for 3 of the species collected.	3	2	6
	16. Statistical Methods and Kinetic	Medium	Some details were omitted; however, these omissions were not likely to have had a substantial impact on the study results (standard deviation bars were shown in the graph).	2	1	2
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	19	15	25
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.67	**Overall Score (Rounded):**	1.7
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Medium

Study Reference:	Zeger, BN; Mets, A; van Bommel, R; Minkenberg, C; Hamers, T; Kamstra, JH; Learmont, JA; Vasquez, BS; Pierce, G; Ried, B; Patterson, T; Rogan, E; Murphy, S; Addink, M; Hartmann, MG; Smeenk, C; Dabin, W; Ridoux, V; González, AF; López, A; Jauniaux, T; Boon, JP. (2004). Stereo-isomer specific bioaccumulation of hexabromocyclododecane (HBCD) in marine mammals. Paper presented at Third International Workshop on Brominated Flame Retardants, June 6-9, 2004, Toronto, Ontario. HERO ID: 4140500					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	Medium	Chemical name was reported; however, the CASRN was reported incorrectly.	2	2	4
	2. Test Substance Purity	High	The test substance was identified by analytical means.	1	1	1
Test Design	3. Study Controls	Medium	Controls were included in the study; however, control results were not reported.	2	2	4
	4. Test Substance Stability	High	The test substance stability, homogeneity, preparation and storage conditions were not reported; however, these factors were not likely to have influenced the test substance or were not likely to have had a substantial impact on the study results.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	7. Testing Consistency	High	Test conditions were consistent across samples or study groups	1	1	1
	8. System Type and Design	Medium	Test system was not fully described.	2	1	2
Test Organisms	9. Test Organism Degradation	High	Test organisms described.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding/ Variable Control	13. Confounding Variables	Medium	Deviations or omissions were not likely to have had a substantial impact on the study results.	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	16. Statistical Methods and Kinetic	Medium	Statistical analysis or kinetic calculations were not conducted or were not described clearly.	2	1	2
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	20	20	27
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.35	**Overall Score (Rounded):**	1.4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	ACC (American Chemistry Council). (2003). Hexabromocyclododecane (HBCD): An activated sludge, respiration inhibition test. (OTS: NA; 8EHQ Num: FYI-03-01472; DCN: 84040000010; TSCATS RefID: NA; CIS: FYI-03-01472). HERO ID: 4269929					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by common name.	1	2	2
	2. Test Substance Purity	High	The test substance source and isomeric composition were reported.	1	1	1
Test Design	3. Study Controls	High	A blank group was included in the study.	1	2	2
	4. Test Substance Stability	High	The test substance stability was included in this study.	1	1	1
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	High	Testing conditions were reported and appropriate for the method.	1	2	2
	7. Testing Consistency	High	No inconsistencies were reported or identified.	1	1	1
	8. System Type and Design	Medium	Some deviations from the protocol were reported, but these were not likely to have impacted the result	2	1	2
Test Organisms	9. Test Organism Degradation	High	Soil and activated sludge sources were reported.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	The outcome assessment was appropriate for this study.	1	1	1
	12. Sampling Methods	High	The sampling was reported and suitable for the study.	1	1	1
Confounding / Variable Control	13. Confounding Variables	High	Concurrent controls for abiotic degradation allowed differentiation between biotic and abiotic degradation.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Data Presentation and Analysis	15. Data Reporting	High	This metric met the criteria for high confidence as expected for this type of study. HBCD concentrations were reported during the study.	1	2	2
	16. Statistical Methods and Kinetic Calculations	High	The analysis of data was clearly described.	1	1	1
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	16	20	21
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.05	**Overall Score (Rounded):**	1.1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Great Lakes Chemical Corporation - Research & Development. (1988). Product information sheet, MSDS, and Toxicity Data Summaries: acute oral rats, acute dermal rabbits, primary skin irritation rabbits, eye irritation rabbits, acute inhalation rats, Ames test, acute fish toxicity test, pilot cataractogenic study in chicks, cataractogenic study in chicks, biodegradation, hydrolysis, partition coefficient, solubility. (OTS: OTS0001106; 8EHQ Num: FYI-OTS-0794-1106; DCN: 84940000189; TSCATS RefID: NA; CIS: FYI-94-001106). HERO ID: 4270831					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance common name was reported.	1	2	2
	2. Test Substance Purity	Medium	The test substance source and purity was not reported.	2	1	2
Test Design	3. Study Controls	Not rated	The study did not require concurrent control groups.	NR	NR	NR
	4. Test Substance Stability	Medium	The test substance stability, homogeneity, preparation, and storage conditions were not reported; however, these factors were not likely to have influenced the test substance or were not likely to have had a substantial impact on the study results.	2	1	2
Test Conditions	5. Test Method Suitability	Medium	Light/dark was not reported but no degradation was reported so did not impact study interpretation.	2	1	2
	6. Testing Conditions	Medium	Temperature and pH details were not reported but were not likely to have had a substantial impact.	2	2	4
	7. Testing Consistency	High	Test conditions were consistent across samples or study groups.	1	1	1
	8. System Type and Design	High	The system type and design were capable of appropriately maintaining substance concentrations.	1	1	1
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	Medium	Bromide ion formation was monitored.	2	1	2
	12. Sampling Methods	High	No notable uncertainties or limitations were expected to influence results.	1	1	1
Confounding/ Variable Control	13. Confounding Variables	High	No reported variability or uncertainty.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	The target chemical and transformation product concentrations, extraction efficiency, percent recovery, and mass balance were not reported; however, they were not likely to have had a substantial impact on the study results.	2	2	4
	16. Statistical Methods and Kinetic	Not rated	Not reported.	NR	NR	NR
Other	17. Verification or Plausibility of Results	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	18	15	23
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.53	**Overall Score (Rounded):**	1.5
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High

Study Reference:	Great Lakes Chemical Corporation - Research & Development. (1988). Product information sheet, MSDS, and Toxicity Data Summaries: acute oral rats, acute dermal rabbits, primary skin irritation rabbits, eye irritation rabbits, acute inhalation rats, Ames test, acute fish toxicity test, pilot cataractogenic study in chicks, cataractogenic study in chicks, biodegradation, hydrolysis, partition coefficient, solubility. (OTS: OTS0001106; 8EHQ Num: FYI-OTS-0794-1106; DCN: 84940000189; TSCATS RefID: NA; CIS: FYI-94-001106). HERO ID: 4270831					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified definitively by common name.	1	2	2
	2. Test Substance Purity	Medium	The test substance source and purity were not reported.	2	1	2
Test Design	3. Study Controls	Medium	Concurrent control group details were not included; however, the lack of data was not likely to have had a substantial impact on the study results.	2	2	4
	4. Test Substance Stability	Low	The test substance stability, homogeneity, preparation and storage conditions were not reported and altered study interpretation.	3	1	3
Test Conditions	5. Test Method Suitability	Unacceptable	Study method details were not reported, making the data unusable.	4	1	4
	6. Testing Conditions	Unacceptable	Testing conditions were not reported, making the data unusable.	4	2	8
	7. Testing Consistency	Not rated	Not applicable; multiple study groups were not reported.	NR	NR	NR
	8. System Type and Design	Unacceptable	Not reported; secondary source; the primary source may contain more detail.	4	1	4
Test Organisms	9. Test Organism Degradation	Unacceptable	The test inoculum source was not reported.	4	2	8
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	Low	Due to limited information, evaluation of the assessment methodology was not possible.	3	1	3
	12. Sampling Methods	Unacceptable	Serious uncertainties or limitations were identified in sampling methods of the outcome(s) of interest and these were likely to have had a substantial impact on the results, resulting in serious flaws, which made the study unusable.	4	1	4
Confounding / Variable Control	13. Confounding Variables	Not rated	No confounding variables were noted.	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Low	There was insufficient evidence presented to confirm that parent compound disappearance was not likely due to some other process.	3	2	6
	16. Statistical Methods and Kinetic	Low	Statistical analysis or kinetic calculations were not conducted or were not described clearly, and the lack of information was likely to have had a substantial impact on the study results.	3	1	3
Other	17. Verification or Plausibility of Results	Not rated	Due to limited information, evaluation of the reasonableness of the study results was not possible.	NR	NR	NR
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	37	17	51
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	3	**Overall Score (Rounded):**	4
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Unacceptable[1]

[1]Study method details were omitted making the data unusable. Consistent with our Application of Systematic Review in TSCA Risk Evaluations document, if a metric for a data source receives a score of Unacceptable (score = 4), EPA will determine the study to be unacceptable. In this case, five of the metrics was rated as unacceptable. As such, the study is considered unacceptable and the score is presented solely to increase transparency.

Study Reference:	U.S. EPA (U.S. Environmental Protection Agency). (2017). IUCLID data set: hexbromocyclododecane. Retrieved from https://java.epa.gov/oppt_chemical_search/. HERO ID: 3970216					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	Composite of 3 lots of commercial grade HBCD, not likely to have impurities that would have affected the results of this study.	1	1	1
Test Design	3. Study Controls	Medium	Not reported in IUCLID report but according to test guidelines, an inoculum blank was most likely tested.	2	2	4
	4. Test Substance Stability	Medium	Not reported in IUCLID report but most likely did not have had a substantial impact on the results.	2	1	2
Test Conditions	5. Test Method Suitability	High	Test method is in accordance with established guidelines.	1	1	1
	6. Testing Conditions	Medium	Testing conditions were not reported but likely were not such that they disqualified the results.	2	2	4
	7. Testing Consistency	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	8. System Type and Design	Medium	Limited system design details were reported; however, the omissions were unlikely to have hindered the interpretation of results.	2	1	2
Test Organisms	9. Test Organism Degradation	High	This metric met the criteria for high confidence as expected for this type of study.	1	2	2
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Medium	Details regarding sampling were left out of the IUCLID summary but were not expected to have had a substantial impact on the study results.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	No data other than the reported 0% degradation were presented. However, omissions were not likely to change the study results.	2	2	4
	16. Statistical Methods and Kinetic	Medium	Statistical methods were not reported; however, their omission was unlikely to have impacted the study results.	2	1	2
Other	17. Verification or Plausibility of Results	Medium	Results were reasonable but no reference substances were used.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	23	20	31
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.55	**Overall Score (Rounded):**	1.6
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High[1]
[1]Although this IUCLID summary omits several details concerning test conditions and sampling methods, the OECD and OPPTS guidelines followed suggest appropriate conditions were met even if not reported in this study.						

Study Reference:	U.S. EPA (U.S. Environmental Protection Agency). (2017). IUCLID data set: hexbromocyclododecane. Retrieved from https://java.epa.gov/oppt_chemical_search/. HERO ID: 3970216					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	Purity was not reported but commercial grade HBCD was unlikely to have impurities that impacted the study results.	2	1	2
Test Design	3. Study Controls	Medium	Controls were not reported. However, the use of radiolabeled HBCD reduces the chance of transformation products existing in the background.	2	2	4
	4. Test Substance Stability	Medium	The test substance preparation and storage conditions were not reported but their omission was unlikely to have impacted the study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	The test substance was added in nominal concentrations above its aqueous solubility so that transformation products could be identified	1	1	1
	6. Testing Conditions	Low	Testing conditions were not reported and would have been given an unacceptable score, however, since this was an IUCLID review, which gave the study a score of '(1) valid without restriction,' disqualifying the study did not seem appropriate.	3	2	6

	7. Testing Consistency	Medium	Testing conditions across groups were not reported as stated in metric 6, but a score of 4 was not given since the IUCLID report likely left out these details.	2	1	2
	8. System Type and Design	Medium	Some system design details were not provided in this secondary source; however, references cited may contain more information.	2	1	2
Test Organisms	9. Test Organism Degradation	Low	Details regarding the inoculum source were not reported but were likely left out by the summary and the study should not be disqualified due to this.	3	2	6
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Low	Sampling methods were not clearly described but were unlikely to have impacted the reported degradation products.	3	1	3
Confounding / Variable Control	13. Confounding Variables	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Data Presentation and Analysis	15. Data Reporting	Medium	The only reported data were the identification of transformation products and 'substantial' degradation of HBCD. Concentrations of transformation products were not given but were not likely to have impacted the study results.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Not rated	No statistical methods or kinetic calculations were reported.	NR	NR	NR
Other	17. Verification or Plausibility of Results	Medium	The study results were reasonable.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	28	19	39
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	2.05	**Overall Score (Rounded):**	2.5
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Low[1]
[1]The study's overall quality rating was downgraded: By itself this report provides very little information about the study. The high rating given to it by IUCLID suggests there is additional information that is not provided here, but without it this report may not be useful.						

Study Reference:	U.S. EPA (U.S. Environmental Protection Agency). (2017). IUCLID data set: hexbromocyclododecane. Retrieved from https://java.epa.gov/oppt_chemical_search/. HERO ID: 3970216					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	Purity was not reported but commercial grade HBCD was unlikely to have impurities that impacted the study results.	2	1	2
Test Design	3. Study Controls	Medium	Controls were not reported. However, the use of radiolabeled HBCD reduces the chance of transformation products existing in the background.	2	2	4
	4. Test Substance Stability	Medium	The test substance preparation and storage conditions were not reported but their omission was unlikely to have impacted the study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	The test substance was added in nominal concentrations above its aqueous solubility so that transformation products could be identified	1	1	1
	6. Testing Conditions	Low	Testing conditions were not reported and would have been given an unacceptable score, however, since this was an IUCLID review, which gave the study a score of '(1) valid without restriction,' disqualifying the study did not seem appropriate.	3	2	6
	7. Testing Consistency	Medium	Testing conditions across groups were not reported as stated in metric 6, but a score of 4 was not given since the IUCLID report likely left out these details.	2	1	2

	8. System Type and Design	Medium	Some system design details were not provided in this secondary source; however, references cited may contain more information.	2	1	2
Test Organisms	9. Test Organism Degradation	Low	Details regarding the inoculum source were not reported but were likely left out by the summary and the study should not be disqualified due to this.	3	2	6
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Low	Sampling methods were not clearly described but were unlikely to have reported degradation products.	3	1	3
Confounding / Variable Control	13. Confounding Variables	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	The only reported data were the identification of transformation products and 'substantial' degradation of HBCD. Concentrations of transformation products were not given but were not likely to have impacted the study results.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Not rated	No statistical methods or kinetic calculations were reported.	NR	NR	NR
Other	17. Verification or Plausibility of Results	Medium	The study results were reasonable.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	28	19	39

High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	2.05	**Overall Score (Rounded):**	2.5
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Low[1]
[1]The study's overall quality rating was downgraded: By itself this report provides very little information about the study. The high rating given to it by IUCLID suggests there is additional information that is not provided here, but without it this report may not be useful.						

Study Reference:	U.S. EPA (U.S. Environmental Protection Agency). (2017). IUCLID data set: hexbromocyclododecane. Retrieved from https://java.epa.gov/oppt_chemical_search/. HERO ID: 3970216					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	Composite of 3 samples, purity was unknown but was not likely to have impacted the study results.	2	1	2
Test Design	3. Study Controls	High	Toxic control using 3,5-dichlorophenol was used.	1	2	2
	4. Test Substance Stability	Medium	The test substance preparation, homogeneity and storage were not reported. Not likely to have impacted the study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	The test method was suitable for the test substance.	1	1	1
	6. Testing Conditions	Low	Some test conditions were not reported (pH and temperature) and may have impacted the study results.	3	2	6
	7. Testing Consistency	Medium	Did not report the number of trials done, only an average was given for inhibition.	2	1	2
	8. System Type and Design	Medium	OECD Guideline 209 was followed; however, details regarding the system setup were not given.	2	1	2
Test Organisms	9. Test Organism Degradation	Medium	Adaptation and source of sludge were not reported but likely did not impact the study results.	2	2	4
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1

	12. Sampling Methods	Medium	Sampling was only done at one time, after 3 hours. Since respiration rates were reported in mg O2/L/hr, a higher sampling frequency would have been better to gain more than one data point.	2	1	2
Confounding / Variable Control	13. Confounding Variables	High	Two control groups with a percent difference in respiration rates of 9.0% were used to establish consistency across sample types.	1	1	1
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	The concentrations of the parent compound and transformation products were not measured; only the respiration rate of the sludge was measured.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Medium	Kinetic calculations were not clearly detailed; however, it was not likely to have had a substantial impact on the results.	2	1	2
Other	17. Verification or Plausibility of Results	Medium	Study results were reasonable. Reference substance results were not reported clearly enough to be useful.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	26	20	35
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.75	**Overall Score (Rounded):**	1.8
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Medium

Study Reference:	U.S. EPA (U.S. Environmental Protection Agency). (2017). IUCLID data set: hexbromocyclododecane. Retrieved from https://java.epa.gov/oppt_chemical_search/. HERO ID: 3970216					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Medium	Purity was not reported but commercial grade HBCD was unlikely to have impurities that impacted the study results.	2	1	2
Test Design	3. Study Controls	Medium	Controls were not reported. However, radiolabeled HBCD was used.	2	2	4
	4. Test Substance Stability	Medium	The test substance preparation and storage conditions were not reported but their omission was unlikely to have impacted the study results.	2	1	2
Test Conditions	5. Test Method Suitability	High	The test substance was added in nominal concentrations above its aqueous solubility so that transformation products could be identified.	1	1	1
	6. Testing Conditions	Low	Testing conditions were not reported and would have been given an unacceptable score; however, since this is an IUCLID review, which gave the study a score of '(1) valid without restriction,' disqualifying the study did not seem appropriate. Also, if the guidelines were followed, testing conditions were adequate and should not have impacted the results.	3	2	6
	7. Testing Consistency	Medium	Testing conditions across groups were not reported, as stated before in metric 6, but a score of 4 was not given since the IUCLID report likely left out these details.	2	1	2

	8. System Type and Design	Medium	Some system design details were not provided in this secondary source; however, references cited may contain more information.	2	1	2
Test Organisms	9. Test Organism Degradation	Low	Details regarding the inoculum source were not reported but were likely left out by the IUCLID summary and the study should not be disqualified due to this.	3	2	6
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
	12. Sampling Methods	Low	Sampling methods were not clearly described but were unlikely to have impacted the reported degradation products.	3	1	3
Confounding / Variable Control	13. Confounding Variables	Medium	Details regarding this metric were limited; however, this source is a robust summary and a routine OECD guideline was cited.	2	1	2
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Medium	The only reported data were the identification of transformation products and 'substantial' degradation of HBCD. Concentrations of transformation products were not given but were not likely to have impacted the study results.	2	2	4
	16. Statistical Methods and Kinetic Calculations	Not rated	No statistical methods or kinetic calculations were reported.	NR	NR	NR
Other	17. Verification or Plausibility of Results	Medium	The study results were reasonable.	2	1	2
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	28	19	39
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	2.05	**Overall Score (Rounded):**	2.5

≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Low[1]
[1]The study's overall quality rating was downgraded: By itself this report provides very little information about the study. The high rating given to it by IUCLID suggests there is additional information that is not provided here, but without it this report may not be useful.						

Study Reference:	ECHA (European Chemicals Agency). (2017). Hydrolysis: hexabromocyclododecane. Helsinki, Finland. Retrieved from https://echa.europa.eu/registration-dossier/-/registered-dossier/15003/5/2/3#. HERO ID: 3970738					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name and CASRN.	1	2	2
	2. Test Substance Purity	Low	The composition of the test substance, Firemaster 100, was not reported. HBCD concentration was completely unknown.	3	1	3
Test Design	3. Study Controls	Not rated	The use of controls was not reported.	NR	NR	NR
	4. Test Substance Stability	Medium	Minimal information regarding Firemaster 100 storage or homogeneity of Firemaster 100 was reported.	2	1	2
Test Conditions	5. Test Method Suitability	Low	Concentration of HBCD in the tests was not reported and therefore could be above the aqueous solubility.	3	1	3
	6. Testing Conditions	Unacceptable	No pH values or temperatures were reported.	4	2	8
	7. Testing Consistency	Unacceptable	No testing conditions were reported for any samples so differences between samples could not be noted.	4	1	4
	8. System Type and Design	Medium	Samples were placed in tightly capped flasks and shaken for an unknown amount of time.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	Low	Bromide ion concentration was mentioned as an analytical method, but no results were reported.	3	1	3
	12. Sampling Methods	Low	Sampling was done twice weekly for pH and bromide ion formation. However, no details were given on the sampling method.	3	1	3
Confounding/ Variable Control	13. Confounding Variables	Unacceptable	No uncertainty or variability was addressed in the report. It is unknown how similar any results were throughout the nine trials.	4	1	4
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Unacceptable	Neither target chemical nor transformation product concentrations were reported. Percent recovery was not reported.	4	2	8
	16. Statistical Methods and Kinetic	Medium	Kinetic calculations were not clearly described but were not likely to impact the results.	2	1	2
Other	17. Verification or Plausibility of Results	Unacceptable	The lack of data in this study renders it useless and if there were any data presented, it would not be useful since there were so many unknowns regarding the methodology.	4	1	4
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	39	16	48
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	3	**Overall Score (Rounded):**	4

≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Unacceptable[1]

[1]Several deficiencies were noted in this secondary source. For example, neither target chemical or transformation product concentrations were reported. Percent recovery was not reported. Consistent with our Application of Systematic Review in TSCA Risk Evaluations document, if a metric for a data source receives a score of Unacceptable (score = 4), EPA will determine the study to be unacceptable. In this case, five of the metrics was rated as unacceptable. As such, the study is considered unacceptable and the score is presented solely to increase transparency.

Study Reference:	Kajiwara, N; Takigami, H. (2013). Behavior of additive brominated flame retardants in textile products. In 5th International Symposium on Brominated Flame Retardants, April 07-April 09, 2010, Kyoto, Japan (pp. 4). Kajiwara, N; Takigami, H. http://dtsc.ca.gov/bfr2013/abstract_download/2010/upload/90074.pdf. HERO ID: 3809158					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	High	The test substance was identified by analytical means.	1	1	1
Test Design	3. Study Controls	Medium	Some concurrent control group details were not included; however, the lack of data was not likely to have had a substantial impact on the study results.	2	2	4
	4. Test Substance Stability	Medium	The test substance stability, homogeneity, preparation, and storage conditions were not reported.	2	1	2
Test Conditions	5. Test Method Suitability	Medium	The test method was likely suitable for the test substance; however, it is unclear how much chemical was exposed to sunlight in the material.	2	1	2
	6. Testing Conditions	Medium	Testing conditions were reported with minor omissions.	2	2	4
	7. Testing Consistency	High	Test conditions were consistent across 2 samples.	1	1	1
	8. System Type and Design	Medium	The system type and design were not fully described.	2	1	2
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR

Outcome Assessment	11. Outcome Assessment Methodology	Low	Deficiencies in the outcome assessment methodology (using samples in fabric to evaluate photodegradation) may have had a substantial impact on the results.	3	1	3
	12. Sampling Methods	High	This metric met the criteria for high confidence as expected for this type of study.	1	1	1
Confounding/ Variable Control	13. Confounding Variables	Low	Sources of variability and uncertainty in the measurements were not considered or accounted for in data evaluation resulting in some uncertainty.	3	1	3
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	High	Target chemical concentration was reported.	1	2	2
	16. Statistical Methods and Kinetic	Not rated	Not applicable.	NR	NR	NR
Other	17. Verification or Plausibility of Results	Not rated	Due to limited information, evaluation of the reasonableness of the study results was not possible.	NR	NR	NR
	18. QSAR Models	Not rated	The metric is not applicable to this study type.	NR	NR	NR
			Sum of scores:	21	16	27
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1.69	**Overall Score (Rounded):**	2.3
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	Low
The study's overall quality rating was downgraded: Data not likely useful for photodegradation in the environment.						

Study Reference:	U.S. EPA (U.S. Environmental Protection Agency). (2012). Estimation Programs Interface Suite™ for Microsoft® Windows, v 4.11 [Computer Program]. Washington, DC. Retrieved from https://www.epa.gov/tsca-screening-tools/epi-suitetm-estimation-program- interface. HERO ID: 2347246					
Domain	**Metric**	**Qualitative Determination [i.e., High, Medium, Low, Unacceptable, or Not rated]**	**Comments**	**Metric Score**	**Metric Weighting Factor**	**Weighted Score**
Test Substance	1. Test Substance Identity	High	The test substance was identified by chemical name.	1	2	2
	2. Test Substance Purity	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
Test Design	3. Study Controls	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
	4. Test Substance Stability	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
Test Conditions	5. Test Method Suitability	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
	6. Testing Conditions	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
	7. Testing Consistency	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
	8. System Type and Design	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
Test Organisms	9. Test Organism Degradation	Not rated	The metric is not applicable to this study type.	NR	NR	NR
	10. Test Organism Partitioning	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Outcome Assessment	11. Outcome Assessment Methodology	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
	12. Sampling Methods	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
Confounding/ Variable Control	13. Confounding Variables	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
	14. Outcomes Unrelated to Exposure	Not rated	The metric is not applicable to this study type.	NR	NR	NR
Data Presentation and Analysis	15. Data Reporting	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
	16. Statistical Methods and Kinetic Calculations	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR
Other	17.Verification or Plausibility of Results	Not rated	The metric is not applicable to this study type (SAR).	NR	NR	NR

	18. QSAR Models	High	The models in EPI SuiteTM have defined endpoints. Chemical domain and performance statistics for each model are known, and unambiguous algorithms are available in the EPI SuiteTM documentation and/or cited references to establish their scientific validity. Many EPI SuiteTM models have correlation coefficients >0.7, cross-validated correlation coefficients >0.5, and standard error values <0.3; however, correlation coefficients (r2, q2) for the regressions of some environmental fate models (i.e.BIOWIN) are lower, as expected, compared to regressions which have specific experimental values such as water solubility or log Kow (octanol-water partition coefficient).	1	1	1
			Sum of scores:	2	3	1
High	Medium	Low	**Overall Score = Sum of Weighted Scores/Sum of Metric Weighting Factors:**	1	**Overall Score (Rounded):**	1
≥1 and <1.7	≥1.7 and <2.3	≥2.3 and ≤3			**Overall Quality Level:**	High