Overview of substance assessments

Summary of the substances assessed using the methodology for the determination of hazardous substances published in January 2017,. It enables comparison between the 1980 groundwater directive and most recent determinations. Further determinations will be made in due course. For a fuller list of substance determinations refer to the JAGDAG website since not all determinations have been or wil need to be assessed uning the 2017 methodology.. You may need to request an assessment if the substance you are looking for is not listed on the JAGDAG website, contact JAGDAG_England@environment-agency.gov.uk to request an assessment.

Substance	CAS #	1980 GWD (List1 or List 2)	JAGDAG Methodology Determination	Based on	Comments
1,1,1-trichloroethane	71-55-6	List I	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	
1,1,2-trichloroethane	79-00-5	List I	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	
1,1-dichloroethane	75-34-3	List I	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	
1,1-dichloroethene	75-35-4	List I	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	1,1-dichloroethene can degrade to form vinyl chloride which has been determined as Hazardous
1,2-dichloroethane	107-06-2	List I	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	
1,2-dichloroethene	540-59-0	List I	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	1,2-dichloroethene can degrade to form vinyl chloride which has been determined as Hazardous
Acrylamide	79-06-1	Not assessed	Hazardous substance	Very Toxic (as Muta 1B and a threshold can not be determined)	Does not meet criteria for P, B and T however meets criteria for Very Toxic based on mutagenicity and the fact it has been reported it is not possible to determine a threshold for this substance
Anionic polyacrylamide	9003-05-8	Not assessed	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	Anionic polyacrylamide is not hazardous however may contain acrylamide as an impurity and this is Hazardous.
Anthracene	120-12-7	List I	Hazardous substance	Meets criteria for PBT	Has been identified as a PBT substance at an EU level and as a result has been identified as a Substance of Very High Concern (SVHC) under REACH
Antimony (V) and (III)	7440-36-0 1309-64-4	Not assessed	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	WHO have noted that Antimony (III) may show genotoxic effects in vivo and in vitro but limited details are given. This may need consideration in the future.
Arsenic (inorganic Arsenic (III) and Arsenic (V)		Not assessed	Hazardous substance	Noted to have not determinable threshold	Does not meet criteria for mutagenic however it has been noted to be genotoxic and that a threshold can not be identified for cancer. COT have proposed that exposure should be as low as reasonably practicable. As a result it meets the criterion relating to a non-threshold chemical
Benzene	71-43-2	List I	Hazardous substance	Very Toxic - Muta 1B	
Benzo(a)pyrene	50-32-8	List I	Hazardous substance	Very Toxic as Muta 1B. Also meets criteria for P, B and T and vPvB	The EU SVHC report for coal tar pitch (high temperature) included an assessment of benzo(a)pyrene and the assessment noted it met the criteria for PBT and vPvB
Benzo(b)fluoranthene	205-99-2	List I	Hazardous substance	Meets criteria for P, B and T	The EU SVHC report for coal tar pitch (high temperature) included an assessment of benzo(k)fluoranthene and the assessment noted it met the criteria for P and T but insufficient experimental data was available for B. However using the weight of evidence have noted it as meeting criteria for P, B and T in this assessment
Benzo(ghi)perylene	191-24-2	List I	Hazardous substance	Meets criteria for P, B and T and vPvB (Assumed Mutagencity due to lack of data - would therefore also meet Very Toxic criteria)	The EU SVHC report for coal tar pitch (high temperature) included an assessment of benzo(ghi)perylene and the assessment noted it met the criteria for PBT and vPvB
Benzo(k)fluoranthene	207-08-9	List I	Hazardous substance	Meets criteria for P, B and T and also vPvB	The EU SVHC report for coal tar pitch (high temperature) included an assessment of benzo(k)fluoranthene and the assessment noted it met the criteria for PBT and vPvB
Boron (as Boron (III)		Not assessed	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	
Cadmium (as cadmium II)		List I	Non-hazardous pollutant	Does not meet the criteria for PBT or vPvB. Is noted to be mutagenic but the WHO have noted that there is limited evidence of genotoxic effects via the oral route and it is not considered to be a no determinable threshold substance for genotoxic effects.	
Chloroalkanes (C10-13)	85535-84-8	List I	Hazardous substance	Meets criteria for PBT and vPvB	The REACH SVHC report indicates it meets the criteria for PBT and vPvB. This group of substances is still being evaluated under REACH however. SCCPs are being considered for inclusion as a POP
Chromium VI	18540-29-9	Not assessed	Hazardous substance	Very Toxic - Muta 2	UK Committee for Mutagenicity has stated that chromium (VI) is mutagenic with no determinable threshold. Based on this have noted Chromium VI is Hazardous. It is acknowledged that other studies/reports indicate may have a threshold but for the purposes of the assessment have taken the current UK position.

Cobalt (based on cobalt (II) which covers cobalt, cobalt carbonate and cobalt sulphate)		Not assessed	Non-hazardous pollutant	Does not meet the criteria for PBT. The EU harmonised classifications for sulfate and carbonate salts on basis of Co(II) indicate Muta 2. A range of evidence has been considered alongside the C&L classification. A number of reviews of the impact of cobalt have been undertaken by a range of organisations including Environment Canada and OECD. The data on the genotoxic effects of cobalt (II) are varying. A review by the EVM (2003) noted mixed results had been obtained for the genotoxicity of cobalt and had derived a threshold. A threshold was also set for cobalt in food contact materials/plastics (EFSA, 2012). The weight of evidence indicates some indication of genotoxicity but that thresholds had been derived in relation to intake and use in contact with foods. As a result it is proposed to determine as non-hazardous at this time based on the available data.	Reviewed following the public consultation in May 2016, it was proposed to be a hazardous substance based on Very Toxic as Muta 2. It is now a non-hazardous pollutant following advice from the Expert Group on Vitamins and Minerals, since a threshold can be determined. Refer to assessment template for further detail.
Cyanide	74-90-8	Not assessed	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	

DEHP	117-81-7	Not assessed	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	DEHP meets the criteria for T based on reproductive effects. The data for persistence indicate ready biodegradability but half lives that meet the criteria. Have noted it as not meeting criteria for persistence to be consistent with outcome of current EU assessments. In terms of bioaccumulation the BCF data for fish don't indicate it meets the criteria. It has not been designated as PBT under REACH as not considered to meet the criteria. However it is noted as a Substance of Very High Concern due to reproductive effects (Repr 1B)
Dibutyl phthalate	84-74-2	Not assessed	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	
Dichloromethane	75-09-2	List I	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	
Dioxins		List I	**Hazardous substance**	Meets criteria for PBT and vPvB	Dioxins have been identified as a Persistent Organic Pollutant (POP)
Ethylene glycol	107-21-1	Not assessed	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	
Flufenacet	142459-58-3	Not assessed	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	
Gluteraldehyde	111-30-8	Not assessed	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	
Hexabromocyclododecane (HBCDD)	25637-99-4	Not assessed	**Hazardous substance**	Meets criteria for P,B and T and vPvB	HBCDD has been designated as a POP. It has been identified as PBT under REACH by the EU
Hexachlorobenzene	118-74-1	List I	**Hazardous substance**	Meets criteria for PBT and vPvB	Has not been formally noted as a PBT substance by the EU. Is designated as a POP
Hexachlorobutadiene (HCBD)	87-68-3	List I	**Hazardous substance**	Meets criteria for P,B and T and vPvB. Also noted to be mutagenic with no determinable threshold and therefore meets the criteria for Very Toxic	HCBD has been designated as a POP.
Hexachlorocyclohexane	58-89-9	List I	**Hazardous substance**	Meets criteria for PBT	Assessment based on gamma- hexachlorocyclohexane CAS: 58-89-9 however also relevant to other isomers eg beta and alpha which are also designated as POPs. It meets the criteria for PBT but has not formally been designated a PBT by the EU Working Group. Is designated as a POP
Indeno(123cd)pyrene	193-39-5	List I	**Hazardous substance**	Meets criteria for P, B and T and vPvB	Limited data available for this substance and have used weight of evidence and information on other PAHs to help make the assessment.
Lead		Not assessed	**Hazardous substance**	WHO and EFSA have noted that there is no known level of lead exposure that is considered safe. Meets criteria for P, B and T.	
Mecoprop	7085-19-0	Not assessed	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	
Mercury (as Mercury II)		List I	**Hazardous substance**	Meets criteria for P, B and T	
Molybdenum (as the molybdate ion)		Not assessed	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	
Naphthalene	91-20-3	List I	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	
Nickel (as nickel II)		Not assessed	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern	Does not meet criteria for PBT or vPvB. Is determined as Muta 2 under CLP however it is considered to have a threshold for genotoxic effects (WHO) and therefore not considered to meet the criteria for determination as Hazardous
Propylene glycol	57-55-6	Not assessed	Non-hazardous pollutant	Does not meet the criteria for P, B or T, vP or vB. Data provided did not indicate any evidence of genotoxic effects.	
Pentachlorobenzene	608-93-5	List I	**Hazardous substance**	Meets criteria for P, B and T and vPvB	Pentachlorobenzene has been designated as a POP
PFOS	1763-23-1	Not assessed	**Hazardous substance**	Meets criteria for PBT	PFOS has been identified as a POP (Persistent Organic Pollutant)
Selenium	7782-49-2	Not assessed	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	
Tetrachloroethylene	127-18-4	List I	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	Known breakdown products following anaerobic degradation include trichloroethylene (determined as Hazardous) and vinyl chloride (determined as Hazardous).
Thallium (as Thallium (I))		Not assessed	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	
Tributyltin (as TBT ion)	56-35-9 36643-28-4	List I	**Hazardous substance**	Meets the criteria for PBT	Has been identified as a PBT substance at an EU level under REACH
Trichlorobenzenes	12002-48-1	List I	Non-hazardous pollutant	Does not meet criteria for P, B and T nor the criteria for Equivalent concern, ie vPvB or mutagenic/no determinable threshold	
Trichloroethylene	79-01-6	List I	**Hazardous substance**	Very Toxic as Muta 2	Available information indicates it can degrade in groundwater to form vinyl chloride (determined as Hazardous).
Vinyl chloride	75-01-4	List I	**Hazardous substance**	Very Toxic as 'no determinable threshold'	WHO drinking water guideline report noted that although a drinking water guideline has been proposed due to its carcinogenic effects exposure levels should be kept as low as practically possible.

1,1, DICHLOROETHENE (1, 1 DCE) (CAS: 75-35-4)				
	Yes / No / Insufficent data / Borderline / assume yes or no?	**Value**	**Reference**	**Comments**
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	No data			
Passes inherent biodegradation test	No data			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	No Data			
Half life fresh or estuarine water ≥ 40 days	Yes	28-180days	Environment Canada (2013)	The main route of removal from the water environment is volatilisation with half lives in the order of hours to a few days. This is not a relevant fate process for groundwater. Modelled half lives in water reported in the range of 28 - 180days. Modelled half lives in groundwater reported in the order of 56 - 132days and other results reported in the range 5- 6 months.
Half life marine sediment ≥ 180 days	No	150days	Environment Canada (2013)	
Half life fresh or estuarine sediment ≥ 120 days	No Data			
Half life in soil ≥ 120 days	Yes	28-180 days	Environment Canada (2013)	The main route of removal from the soil environment is volatilisation with half lives reported in the order of hours to a few days. Modelled half lives in soil reported in the order of 28 - 180 days.
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			Limited data available. Volatilisation is a key removal process but not directly relevant in groundwater. Using the upper modelled degradation rates indicates meets the criteria for persistence.
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	4 - <13	WHO 2003	Two studies in fish. Substance noted to be difficult to test due to volatility. BCF values of 4 and 6.9 also noted in Environment Canada (2013)
Does field data show evidence for biomagnification?	No data			
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	1.32	WHO 2003	Value of 2.1 noted in Environment Canada (2013) which supports the fact it does not meet the
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed as data available above			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	3.9 mg/l	WHO 2003	*Alga Chlamydomonas reinhardtii 72 hr EC10 (broadly used as a surrogate for NOEC)* ; Substance difficult to test due to volatility
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	EU harmonised C&L classification available for 1,1-dichloroethene and indicates it does not meet the criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database	Classified Carc.2 (EU harmonised C&L classification)
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**No**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Doesn't meet criteria for B or T**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes	28-180	Environment Canada (2013)	The main route of removal from the water environment is volatilisation with half lives in the order of hours to a few days. This is not a relevant fate process for groundwater. Modelled half lives in water reported in the range of 28 - 180days. Modelled half lives in groundwater reported in the order of 56 - 132days and other results reported in the range 5- 6 months.
Half life in marine, fresh or estuarine sediment ≥ 180 days	No	150	Environment Canada (2013)	
Half life in soil ≥ 180 days	Yes	28-180	Environment Canada (2013)	The main route of removal from the soil environment is volatilisation with half lives reported in the order of hours to a few days. Modelled half lives in soil reported in the order of 28 - 180 days.
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	4 - <13	WHO 2003	Two studies in fish. Substance noted to be difficult to test due to volatility. BCF values of 4 and 6.9 also noted in Environment Canada (2013)
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Doesn't meet criteria for vB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not Assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not Assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not Assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not Assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	Not Assessed			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	EU harmonised C&L classification indicates it does not meet the criteria for mutagenicity. WHO (2005) noted that it was not relevant to determine a drinking water threshold for 1,1-dichloroethene
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No (see comment)**			**NB. Dichloroethene can result in the formation of vinyl chloride (determined as Hazardous) during degradation in groundwater.**

Does substance have breakdown products of concern? **Vinyl chloride (which has been determined as Hazardous) is a known breakdown product**

REFERENCES

Environment Canada (2013) - Screening Assessment http://www.ec.gc.ca/ese-ees/FC365319-CDD2-4984-B78B-884F42C3C207/DCE_FSAR_EN.pdf
ECHA-C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/cl-inventory/view-notification-summary/68396
WHO (2003). Concise International Chemical Assessment Document 51 - 1,1-DC http://apps.who.int/iris/bitstream/10665/42634/1/9241530510.pdf
WHO (2005) 1,1-dichloroethene in drinking water http://www.who.int/water_sanitation_health/dwq/chemicals/11dichloroethenefinal.pdf?ua=1

1,1-dichloroethane (CAS: 75-34-3)

	Yes / No / Insuffcent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes readv biodegradation test				
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days				
Half life fresh or estuarine water ≥ 40 days	Yes			A key removal process for 1,1-dichloroethane is volatilisation with half lives reported in a few hours/days. However as groundwater is being considered this is not thought to be relevant for this particular assessment. Few studies on biodegradation found and it is noted that biodegradation is not a key removal process. A study on degradation in groundwater reported half lives in the order of 8 to 16 weeks in a sample of aerobic groundwater (Ref: ATSDR). Another study on water from a landfill indicated a half life of 115days (Ref: ATSDR). Due to the limited data for 1,1-dichloroethane have also considered the data for 1,2-dichloroethane which also suggested low rates of biodegradation (SIDS, 2002). Based on the available data have therefore assumed that 1,1-dichloroethane meets the criteria for persistence.
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days				
Half life in soil ≥ 120 days				
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)				
Is substance persistent?	**Yes**			See comments noted above
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	5	HSDB	An estimated BCF value calculated from the log Kow. No experimental data located
Does field data show evidence for biomagnification?	No data			No specfic data on biomagnification but not expected to biomagnify based on the BCF and log Kow data
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	1.79	HSDB	
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not considered due to above information			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	11mg/l	SIDS (2002)	No chronic data located for 1,1-dichloroethane. Data for 1,2-dichloroethane has therefore been used (chronic NOEC for Daphnia magna of 11mg/l)
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	Harmonised C&L classification available for 1,1-dichloroethane. The classification indciates it does not meet the criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database	Harmonised C&L classification available for 1,1-dichloroethane. The classification indciates it does not meet the criteria
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**No**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Very little data available for this substance. Information for 1,2-dichloroethane has also been considered as part of the assessment where necessary. The data located indicate it does not meet criteria for B or T.**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes			A key removal process for 1,1-dichloroethane is volatilisation with half lives reported in a few hours/days. However as groundwater is being considered this is not thought to be relevant for this particular assessment. Few studies on biodegradation found and it is noted that biodegradation is not a key removal process. A study on degradation in groundwater reported half lives in the order of 8 to 16 weeks in a sample of aerobic groundwater (Ref: ATSDR). Another study on water from a landfill indicated a half life of 115days (Ref: ATSDR). Due to the limited data for 1,1-dichloroethane have also considered the data for 1,2-dichloroethane which also suggested low rates of biodegradation (SIDS 2002). Based on the available data have therefore assumed that 1,1-dichloroethane meets the criteria for persistence.
Half life in marine, fresh or estuarine sediment ≥ 180 days				
Half life in soil ≥ 180 days				
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	5	HSDB	An estimated BCF value calculated from the log Kow. No experimental data located
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Does not meet criteria for vB. Very little data available for persistence - have assumed vP based on the limited data available.**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?				
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	Harmonised C&L classification available for 1,1-dichloroethane. The classification indciates it does not meet the criteria
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)				
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Does not meet criteria for PBT as not B or T. Does not meet vPvB as not bioaccumulative. Does not meet criteria for Very Toxic does not meet the criteria for mutagenicity.**
Does substance have breakdown products of concern?	**No**			

REFERENCES

HSDB http://toxnet.nlm.nih.gov/cgi-bin/sis/search2/f?./temp/~yhCYkS:1
ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database
SIDS (2002) (Assessment on 1,2-dichloroethane) http://www.inchem.org/documents/sids/sids/DICHLOROETH.pdf
ATSDR http://www.atsdr.cdc.gov/toxprofiles/tp133-c6.pdf

1,2-dichloroethane (CAS: 107-06-2)				
	Yes / No / Insufficent data / Borderline / assume yes or no?	**Value**	**Reference**	**Comments**
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test				
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Yes (see comment)		SIDS(2002)	No specific half life data was available for this substance. The OECD SIDS review indicated that available studies showed it was not biodegraded when non-adapted, non-acclimated microbial populations were used however biodegradation did occur when adapted microbes were used. No half lives were provided. It was noted that under environmental conditions biodegradation is not likely to occur. 1,2-dichloroethane is rapidly volatilised from surface water with half lives in the order of hours but this has not been considered here as groundwater is the main medium of interest rather than surface water.Have assumed that it meets the criteria for persistence based on the available data.
Half life fresh or estuarine water ≥ 40 days	Yes (See comment above)		SIDS(2002)	
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days				
Half life in soil ≥ 120 days				
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			**Used data for situations with non-adapted, non-accumulated conditions which indicate slow degradation. No specific half lives available and have assumed it meets the criteria for persistence.**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	2	SIDS (2002)	Measured value from a study on a fish species (Bluegill sunfish)
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	1.45	SIDS (2002)	Measured value
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed due to the information provided above			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	11mg/l	SIDS (2002)	A range of toxicity data was collated for the SIDS report. The lowest chronic value was 11mg/l for an invertebrate (*Daphnia magna* - 28day NOEC)
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	Harmonised C&L classification for 1,2-dichloroethane indicates it does not meet the criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Carc 1B	ECHA C&L database	Harmonised C&L classification for 1,2-dichloroethane indicates it does not meet the criteria
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			**Based on the fact it has been assigned Carc 1B under CLP**
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet the criteria for bioaccumulation**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes		SIDS(2002)	No specific half life data was available for this substance. The OECD SIDS review indicated that available studies showed it was not biodegraded when non-adapted, non-acclimated microbial populations were used however biodegradation did occur when adapted microbes were used. No half lives were provided. It was noted that under environmental conditions biodegradation is not likely to occur. 1,2-dichloroethane is rapidly volatilised from surface water with half lives in the order of hours but this has not been considered here as groundwater is the main medium of interest rather than surface water.Have assumed that it meets the criteria for persistence based on the available data.
Half life in marine, fresh or estuarine sediment ≥ 180 days				
Half life in soil ≥ 180 days				
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	2	SIDS (2002)	Measured value from a study on the Bluegill sunfish
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**No specific data available on degradation half lives however does not meet vB criteria therefore not vPvB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?				
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	Harmonised C&L classification for 1,2-dichloroethane indicates it does not meet the criteria
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Does not meet the criteria for P, B and T, nor vPvB or Very Toxic**
Does substance have breakdown products of concern?	**No**			
REFERENCES				
SIDS (2002) Initial Assessment report on 1,2-dichloroethane	http://www.inchem.org/documents/sids/sids/DICHLOROETH.pdf			
ECHA C&L database	http://echa.europa.eu/information-on-chemicals/cl-inventory-database			

1,1, DICHLOROETHENE (1, 1 DCE) (CAS: 75-35-4)				
	Yes / No / Insufficent data / Borderline / assume yes or no?	**Value**	**Reference**	**Comments**
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	No data			
Passes inherent biodegradation test	No data			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	No Data			
Half life fresh or estuarine water ≥ 40 days	Yes	28-180days	Environment Canada (2013)	The main route of removal from the water environment is volatilisation with half lives in the order of hours to a few days. This is not a relevant fate process for groundwater. Modelled half lives in water reported in the range of 28 - 180days. Modelled half lives in groundwater reported in the order of 56 - 132days and other results reported in the range 5- 6 months.
Half life marine sediment ≥ 180 days	No	150days	Environment Canada (2013)	
Half life fresh or estuarine sediment ≥ 120 days	No Data			
Half life in soil ≥ 120 days	Yes	28-180 days	Environment Canada (2013)	The main route of removal from the soil environment is volatilisation with half lives reported in the order of hours to a few days. Modelled half lives in soil reported in the order of 28 - 180 days.
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			Limited data available. Volatilisation is a key removal process but not directly relevant in groundwater. Using the upper modelled degradation rates indicates meets the criteria for persistence.
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	4 - <13	WHO 2003	Two studies in fish. Substance noted to be difficult to test due to volatility. BCF values of 4 and 6.9 also noted in Environment Canada (2013)
Does field data show evidence for biomagnification?	No data			
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	1.32	WHO 2003	Value of 2.1 noted in Environment Canada (2013) which supports the fact it does not meet the
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed as data available above			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	3.9 mg/l	WHO 2003	*Alga Chlamydomonas reinhardtii 72 hr EC10 (broadly used as a surrogate for NOEC)* ; Substance difficult to test due to volatility
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	EU harmonised C&L classification available for 1,1-dichloroethene and indicates it does not meet the criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database	Classified Carc.2 (EU harmonised C&L classification)
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**No**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Doesn't meet criteria for B or T**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes	28-180	Environment Canada (2013)	The main route of removal from the water environment is volatilisation with half lives in the order of hours to a few days. This is not a relevant fate process for groundwater. Modelled half lives in water reported in the range of 28 - 180days. Modelled half lives in groundwater reported in the order of 56 - 132days and other results reported in the range 5- 6 months.
Half life in marine, fresh or estuarine sediment ≥ 180 days	No	150	Environment Canada (2013)	
Half life in soil ≥ 180 days	Yes	28-180	Environment Canada (2013)	The main route of removal from the soil environment is volatilisation with half lives reported in the order of hours to a few days. Modelled half lives in soil reported in the order of 28 - 180 days.
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	4 - <13	WHO 2003	Two studies in fish. Substance noted to be difficult to test due to volatility. BCF values of 4 and 6.9 also noted in Environment Canada (2013)
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Doesn't meet criteria for vB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not Assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not Assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not Assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not Assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	Not Assessed			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	EU harmonised C&L classification indicates it does not meet the criteria for mutagenicity. WHO (2005) noted that it was not relevant to determine a drinking water threshold for 1,1-dichloroethene
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No (see comment)**			**NB. Dichloroethene can result in the formation of vinyl chloride (determined as Hazardous) during degradation in groundwater.**

Does substance have breakdown products of concern? **Vinyl chloride (which has been determined as Hazardous) is a known breakdown product**

REFERENCES

Environment Canada (2013) - Screening Assessment http://www.ec.gc.ca/ese-ees/FC365319-CDD2-4984-B78B-884F42C3C207/DCE_FSAR_EN.pdf
ECHA-C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/cl-inventory/view-notification-summary/68396
WHO (2003). Concise International Chemical Assessment Document 51 - 1,1-DC http://apps.who.int/iris/bitstream/10665/42634/1/9241530510.pdf
WHO (2005) 1,1-dichloroethene in drinking water http://www.who.int/water_sanitation_health/dwq/chemicals/11dichloroethenefinal.pdf?ua=1

1,1,1-trichloroethane (CAS: 71-55-6)

Is substance persistent, bioaccumulative and toxic?	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Persistence				
Passes ready biodegradation test	No		SIDS (2009)	OECD 301C 0% degradation after 14days
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days				
Half life fresh or estuarine water ≥ 40 days	Yes	0.5-1 year	SIDS (2009)	Very limited data was available on half lives of 1,1,1-trichloroethane in water. The information found generally indicated slow degradation. It is rapidly volatilised however this isn't considered relevant for groundwater. The SIDS review noted a half life of 0.5 - 1year for 1.1.1-trichloroethane in water
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days				
Half life in soil ≥ 120 days	Yes	>485days	HSDB	
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			Limited data was available on half lives for 1,1,1-trichloroethane but overall the available data indicated slow degradation
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	9	SIDS (2009)	BCF value reported for fish of 9
Does field data show evidence for biomagnification?	No data			
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	2.47	SIDS (2009)	This is a measured value
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed due to the above information			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	0.213	SIDS (2009), NICNAS (2016)	A 3d EC10 for the alga Chlamydomonas reihardtii of 0.213mg/l. Data for Daphnia magna showed a 17d NOEC of 1.3mg/l and for fish a 14d NOEC of 7.7mg/l for Cyprinus carpio
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	Harmonised C&L classification for 1,1,1-trichloroethane indicates it does not meet the criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database	Harmonised C&L classification for 1,1,1-trichloroethane indicates it does not meet the criteria
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**No**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet criteria for B or T**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes	0.5-1 year	SIDS (2009)	Very limited data was available on half lives of 1,1,1-trichloroethane in water. The information found generally indicated slow degradation. It is rapidly volatilised however this isn't considered relevant for groundwater. The SIDS review noted a half life of 0.5 - 1year for 1.1.1-trichloroethane in water
Half life in marine, fresh or estuarine sediment ≥ 180 days				
Half life in soil ≥ 180 days	Yes	>485days	HSDB	Limited data was available on half lives for 1,1,1-trichloroethane
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	9	SIDS (2009)	BCF value reported for fish of 9
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Does not meet criteria for B**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	Harmonised C&L classification for 1,1,1-trichloroethane indicates it does not meet the criteria
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Does not meet criteria for P, B and T nor vPvB or Very Toxic**
Does substance have breakdown products of concern?	**No**			

REFERENCES

SIDS (2009) - Assessment on 1,1,1-trichloroethane	http://webnet.oecd.org/Hpv/ui/handler.axd?id=63fd92e5-0eda-4cca-94dc-267d8a6c5f09
ECHA C&L database	http://echa.europa.eu/information-on-chemicals/cl-inventory-database
HSDB	http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB
NICNAS (2016)	https://www.nicnas.gov.au/chemical-information/imap-assessments/imap-assessments/tier-ii-environment-assessments/1,1,1-trichloroethane

1,1,2-trichloroethane (CAS: 79-00-5)

Is substance persistent, bioaccumulative and toxic?	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Persistence				
Passes ready biodegradation test	No		SIDS (2000)	Based on results from an OECD 301C study which showed 5% degradation after 28days)
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days				
Half life fresh or estuarine water ≥ 40 days	Yes	85days	SIDS (2000)	1,1,2-trichloroethane is very volatile however this is not a relevant route of removal in groundwater. It is noted to be stable in water at pHs of 4 and 7 with a half life of 85 days reported at pH 9. A half life of 16years was noted in an anaerobic aquifer (HSDB)
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days				
Half life in soil ≥ 120 days	Yes	6months to 1year	HSDB	Half life data in aerobic soils was noted as 6months to 1 year.
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	0.7-4	SIDS (2000)	BCF values reported for fish
Does field data show evidence for biomagnification?	No data			
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	2.05	SIDS (2000)	Measured value
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed due to above data			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	3	SIDS (2000)	Lowest chronic data was for the fish Pleuronectes platessa 56d NOEC 3mg/l
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	Harmonised C&L classification indicates it does not meet the criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database	Harmonised C&L classification ntoes it is classified as Carc 2 and therefore does not meet the crtieria
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**No**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet criteria for B or T**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes	85days	SIDS (2000)	1,1,2-trichloroethane is very volatile however this is not a relevant route of removal in groundwater. It is noted to be stable in water at pHs of 4 and 7 with a half life of 85days reported at pH 9. A half life of 16years was noted in an anaerobic aquifer (HSDB)
Half life in marine, fresh or estuarine sediment ≥ 180 days				
Half life in soil ≥ 180 days	Yes	6months to 1year	HSDB	Half life data in aerobic soils was noted as 6months to 1 year.
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	0.7-4	SIDS (2000)	BCF values reported for fish
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Does not meet criteria for B**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?				
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	Harmonised C&L classification indicates it does not meet the criteria.
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Does not meet the criteria for P, B and T nor vPvB or Very Toxic**
Does substance have breakdown products of concern?	**No**			

REFERENCES

ECHA C&L database https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/127060
SIDS (2000) Assessment review of 1,1,2-trichloroethane http://www.inchem.org/documents/sids/sids/79005.pdf
HSDB https://toxnet.nlm.nih.gov/cgi-bin/sis/search2/f?./temp/~BkMEz6:1

Acrylamide (CAS: 79-06-1)

	Yes / No / Insufficient data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	Yes		EU RAR(2002) /NICNAS (2002)	The ESR noted that acrylamide is readily biodegradable when concentrations of 1mg/l and 2mg/l were tested with 100% degradation observed after 28days. At a concentration of 5mg/l a reduced degradation was observed with 53% degradation after 28days. The question whether this reduction was due to effects on micro-orgnaisms was raised.
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	No	10.4days	EU RAR (2002)	Complete primary degradation noted after 10.4days. A lag phase of approx 7 days was reported.
Half life fresh or estuarine water ≥ 40 days	No	4.2 - 5.2days	EU RAR (2002)	The degradation rates given relate to complete primary degradation. For degradation of acrylamide there is reported to be a lag phase with degradation rates being reported to be quicker when micro-organisms are acclimated. A study reported by the US EPA noted complete degradation of 10-20ppm acrylamide in river water occurred in about 12 days with non acclimated micro-organisms, when the micro-organisms were acclimated, degradation was complete in 2 days (US EPA 1994)
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days				
Half life in soil ≥ 120 days	No	30 days	EU RAR (2002)	EU RAR - estimated half life in soil 30 days. A study noted by the US EPA showed biodegradation is the major route of removal of acrylamide from soils. In aerobic soils the chemical is 74-94% degraded in 14days while in waterlogged anaerobic soil 64-89% is degraded in 14 days, depending on the soil type. Estimated half lives range from 21 to 36hrs. (US EPA 1994)
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**No**			
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	<1	EU RAR (2002)	EU RAR reports that BCF values for aquatic organisms were all <1.
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	-1	EU RAR (2002)	This value was used as the Log Kow in the EU risk assessment. The RAR reported log Kow values in the range of -0.67 to -1.65
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not considered due to above data			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	2mg/l	EU RAR (2002)	28d NOEC for the invertebrate Mysidopsis bahia
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	Yes	STOT RE1	ECHA C&L database	Harmonised C&L classification for acrylamide indicates it meets the criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Carc 1B, Muta 1B, Repr 2	ECHA C&L database	Harmonised C&L classification for acrylamide indicates it meets the criteria
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Meets T criteria but not B or P**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	No	4.2 - 5.2 days	EU RAR (2002)	See information in the persistence section above
Half life in marine, fresh or estuarine sediment ≥ 180 days				
Half life in soil ≥ 180 days	No	30 days	EU RAR (2002)	See information in the persistence section above
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	<1	EU RAR (2002)	See information in the bioaccumulation section above
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Meets neither vP or vB criteria**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	Yes	Muta 1B	ECHA C&L database /WHO 2011/COM	Harmonised C&L classification for acrylamide is available. The WHO (2011) report reviews the drinking water threshold for acrylamide and notes that the value of 0.5ug/l is retained with the additional proviso that exposure should be reduced to as low a level as technically achievable. The Committee on Mutagenicity (COM) have considered acrylamide and note that it is mutagenic and that a threshold can not be determined
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**Yes**			**Meets the criteria for Very Toxic due to being mutagenic. COM note that it is not possible to determine a threshold for this substance and WHO note that exposure should be reduced to as low as technically feasible.**
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**Determination as Hazardous based on 'Very Toxic' as Muta 1B. WHO and COM have noted it is not possible to determine a threshold for mutagenicity**
Does substance have breakdown products of concern?	**No**			

REFERENCES

EU RAR Acrylamide (2002)	http://echa.europa.eu/documents/10162/50218bf9-ba0f-4254-a0d9-d577a5504ca7
ECHA C&L database	https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discl/details/104230
US EPA (1994)	http://www.epa.gov/chemfact/s_acryla.txt
NICNAS (2002)	http://www.nicnas.gov.au/__data/assets/pdf_file/0019/4384/PEC_23_Acrylamide_Full_Report_PDF.pdf
COM - Statement on acrylamide (Committee on Mutagenicity COM/07/S2)	https://cot.food.gov.uk/sites/default/files/cot/comsection07.pdf
WHO (2011)	http://www.who.int/water_sanitation_health/dwq/chemicals/acrylamide.pdf

	Anionic Polyacrylamide (CAS: 9003-05-8)			
	Yes / No / Insufficent data / Borderline / assume yes or no?	**Value**	**Reference**	**Comments**
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	No		Magnafloc 156 data sheet	
Passes inherent biodegradation test	No data			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	No Data			
Half life fresh or estuarine water ≥ 40 days	No Data			
Half life marine sediment ≥ 180 days	No Data		Sojka et al (2007)	Strong affinity for sediments and soils
Half life fresh or estuarine sediment ≥ 120 days	No Data			
Half life in soil ≥ 120 days	Assume Yes	10% degradation in 1 year	Sojka et al (2007)	
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	No			
Is substance persistent?	**Yes**			Assumed yes based on degradation rate quoted and the fact it is noted to not be readily biodegradable
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No data			
Does field data show evidence for biomagnification?	No data			
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No data			
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?				
Substance is chronically non-toxic in mammals	Yes		ANON (2005)	Polyacrylamide itself is not significantly toxic.
Molecular size ≥ 4.3nm	Yes		Weston (2009)	The size of the molecule would prevent passage across biological membranes. References Stephens, S.H. 1991. Final report on the safety assessment of polyacrylamide. J. Am. Coll. Toxicol. 10:193–202
Molecular weight ≥ 1100g/mol	Yes		Sojka et al (2007)	Large molecular weight anionic PAMs.
Octanol solubility ≤ 0.002mmol/l	No data			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			Weight of evidence indicates it does not meet the cirtiera for B
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	0.25mg/l	Weston et al (2009)	*Ceriodaphnia dubia* 7 day test LC50 0.25mg/l. This was based on an oil based product and oher non-oil based anionic polyacrylamide based products showed lower toxicity with the water based studies showing an IC50 of >100mg/l
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA-C&L database	No EU harmonised classification available. Limited industry notifications on the C&L database with none indicating it meets these criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA-C&L database	No EU harmonised classification available. Limited industry notifications on the C&L database with none indicating it meets these criteria
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)				
Is substance toxic?	**No**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			Assumed P but not T or B
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	No data			
Half life in marine, fresh or estuarine sediment ≥ 180 days	No data			
Half life in soil ≥ 180 days	Assume Yes	10% degradation in 1 year	Sojka et al (2007)	
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No			No BCF data but see weight of evidence above
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Assumed P but not B due to weight of evidence**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not Assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not Assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not Assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not Assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not Assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA-C&L database	No EU harmonised classification available. Limited industry notifications on the C&L database with none indicating it meets these criteria.
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			Although an EU C&L classification is not available the weight of evidence indicates it is unlikely to meet these criteria. Anionic polyacrylamide products can be used in drinking water treatment and also in a number of products in contact with food, eg packaging.
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No (see comment)**			**NB. Anionic polyacrylamide has been assessed as not Hazardous based on the available information. Acrylamide is often present as an impurity in anionic polyacrylamide however the amount present is tightly controlled with residual acrylamide in polyacrylamide products generally <0.1% and in those used for potable water treatment <0.05%. There are differing opinions on whether acrylamide can be formed from the degradation of polyacrylamide however the EU risk assessment on acrylamide concluded that this is unlikely to occur. Therefore presence of acrylamide is linked to its presence as an impurity rather than a breakdown product. Acrylamide has veen determined to be Hazardous**

Does substance have breakdown products of concern?

There are differing opinions on whether acrylamide can be formed from the degradation of polyacrylamide. However the EU risk assessment on acrylamide concluded that this is unlikely to occur as it would be an energetically unfavourable reaction. However acrylamide may be present in polyacrylamide as an impurity although residual acrylamide in polyacrylamide products is controlled.

REFERENCES

EU RISK ASSESSMENT(2002)- ACRYLAMIDE http://echa.europa.eu/documents/10162/50218bf9-ba0f-4254-a0d9-d577a5504ca7
ECHA-C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/cl-inventory/view-notification-summary/58579
ANON (2005) http://www.ncbi.nlm.nih.gov/pubmed/16154914
Weston et al (2009) http://eprints.nwisrl.ars.usda.gov/1307/1/1284.pdf
Sojka et al (2007) http://naldc.nal.usda.gov/naldc/download.xhtml?id=15474&content=PDF
Magnafloc 156 product data sheet http://bluemsds.tdgmond.be/files/msds/Magnafloc%20156.pdf

Anthracene (CAS: 120-12-7)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	No		EU SVHC report (2008)	MITI study showed 1.9% degradation which indicates not readily biodegraded
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Yes		EU SVHC report (2008)	No specific half life values were provided but it was stated that available studies showed slow to very slow degradation. It noted that once released to the water environment it would adsorb to sediment
Half life fresh or estuarine water ≥ 40 days	Yes			
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days	Yes	210 days	EU SVHC report (2008)	Study reported indicating half life in aerobic sediments of 210days but that it is recalcitrant in anaerobic sediments
Half life in soil ≥ 120 days	Yes	7.9 years	EU SVHC report (2008)	
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	900-6760	EU SVHC report (2008)	Experimentally determined BCF values for fish
Does field data show evidence for biomagnification?	No data			
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Yes	4.68	EU SVHC report (2008)	
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not assessed due to above information			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**Yes**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.0012mg/l	EU SVHC report (2008)	Chronic NOEC for the bluegill sunfish. Chronic effect concentrations reported in similar concentrations for some invertebrates
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	A formal C&L classification has not been made. Industry proposals submitted suggest it is not classified as STOT RE1 or RE2.
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database	A formal C&L classification has not been made. Industry proposals submitted suggest it is not classified as CMR. This is supported by data on the EU ESR risk assessment which indicates that the available data indicates is not considered to meet these criteria.
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			**Based on chronic aquatic toxicity data**
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**Yes**			Anthracene has been agreed at EU level as a PBT substance and as a result has been determined as a Substance of Very High Concern (SVHC) under REACH
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes		EU SVHC report (2008)	No specific half life values were provided but it was stated that available studies showed slow to very slow degradation. It noted that once released to the water environment it would adsorb to sediment
Half life in marine, fresh or estuarine sediment ≥ 180 days	Yes	210 days	EU SVHC report (2008)	Study reported indicating half life in aerobic sedimetns fo 210days but that it is recalcitrant in anaerobic sediments
Half life in soil ≥ 180 days	Yes	7.9 years	EU SVHC report (2008)	
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	Yes	900-6760	EU SVHC report (2008)	BCF values for fish considered to be reliable
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**Yes**			**The data indicates it meets both vP and vB criteria however the SVHC report does not note it as vPvB, and only mentions vP.**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?				
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	A formal C&L classification has not been made. Industry proposals submitted suggest it is not classified mutagenic. This is supported by information in the EU ESR risk assessment which indicates that it is not thought to be mutagenic.
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)				
Is substance very toxic?	**No**			**Although a formal C&L classification has not been made the industry proposals indicate it has not been classified as mutagenic**
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**Anthracene has been designated as a PBT substance at EU level and has been classified as a Substance of Very High Concern under REACH**
Does substance have breakdown products of concern?	**No**			

REFERENCES

EU Risk Assessment on Anthracene (2008) nts/10162/08a49c89-9171-4cb2-8366-108601ac565c
SVHC (2008) https://echa.europa.eu/candidate-list-table/-/dislist/details/0b0236e1807d8567
ECHA C&L database https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/101102
ECB (2008) https://echa.europa.eu/documents/10162/4253c935-2286-42a4-a0a8-d6302443dbce

Antimony as Antimony(V) and (III) cations, covering Antimony (CAS 7440-36-0) & Diantimony trioxide (CAS 1309-64-4)

Diantimony trioxide solubility is low, suggesting dissociation/release of Sb ions may be slow. Antimony metal will release ions at particles' surface, again release rate dictated by aqueous characteristics. Sb(III) is potentially oxidised to Sb(V) depending on conditions: "Upon dissolution in oxic systems, Sb(III) isreadily oxidized to Sb(V), which easily hydrolyses to form the anion Sb(OH)6-. Johnson et al. (2005) presented a solubility product constant (Ksp = [Ca2+][Sb(OH)6]2) of 10-12.55, which predicts a maximal antimony concentration of 0.012 mM or 1.44 mg Sb/L at 2 mM calcium. This corresponds to an antimony trioxide concentration of 1.73 mg/L. Since reconstituted standard water is more relevant for natural water conditions, the value of 2.76 mg/L will be used forthe screening assessment of ecological risks." at low pH Sb(III) is the dominant dissolved form, while at high pH Sb(V) dominates.

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	Test not applicable for metal/inorganic			
Passes inherent biodegradation test	Test not applicable for metal/inorganic			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Degradation testing not applicable for metal/inorganic			
Half life fresh or estuarine water ≥ 40 days	See above			
Half life marine sediment ≥ 180 days	See above			
Half life fresh or estuarine sediment ≥ 120 days	See above			
Half life in soil ≥ 120 days	See above			
Other relevant information (e.g. dissolution/transformation for metals/inrganics)	Yes	360 days	EU RAR(2008)	Data quoted based on Sb_2O_3 transforming to a more soluble form of Sb after an incubation test involving sandy/loam soils.
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			**Persistence criteria were developed for organics. Metals and inorganics such as antimony are inherently persistent and are subject to transformation rather than degradation.**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	<2000	EU RAR (2008); Environment Canada (2010)	Data for freshwater species indicates a low potential for bioaccumulation that is regulated in many tested organisms. No study was fully reliable, and many BCFs were derived from field measurements which introduces many uncertainties. The EU RAR used BCFs of both 40 (freshwater) and 15000 (marine) for modelling secondary poisoning however this is not relevant when assessing B against PBT criteria. Based on a weight of evidence, bioaccumulation of Sb is considered to be below the B criterion.
Does field data (BAF, BMF, TMF) show evidence for bioaccumulation?	No	-	EU RAR(2008)	Biomagnification is considered unlikely to occur as low antimony levels were found in higher animals.
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Not applicable for metals			Log Kow are not considered reliable estimates of the potential for bioaccumulation of inorganic substances such as antimony.
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed due to the availability of the above information			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			Weight of evidence used as no one study considered reliable
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	1.13 mg/L	EU RAR(2008); Environment Canada (2010)	Chronic data for algae, invertebrates and fish were within an order of magnitude. The lowest NOEC (1.13 mg Sb/l) for fish *(Pimephales promelas)* .
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	Harmonised C&L classification for diantimony trioxide indicates does not meet the criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No	Carc. 2	ECHA C&L database	Harmonised C&L classification for diantimony trioxide indicates does not meet the criteria
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**No**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**	**P, not B, Not T**		**It is noted that the WHO report outlining the drinking water guideline notes that Antimony (III) may show genotoxic effects in vivo and in vitro but limited details are given. This may need consideration in the future.**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Degradation testing not applicable for metal/inorganic			
Half life in marine, fresh or estuarine sediment ≥ 180 days	See above			
Half life in soil ≥ 180 days	See above			**Persistence criteria were developed for organics. Metals and inorganics such as antimony are inherently persistent and are subject to transformation rather than degradation.**
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	<2000	EU RAR (2008)	Data for freshwater species indicates a low potential for bioaccumulation that is regulated in many tested organisms. No study was fully reliable, and many BCFs were derived from field measurements which introduces many uncertainties. The EU RAR used BCFs of both 40 (freshwater) and 15000 (marine) for modelling secondary poisoning however this is not relevant when assessing B against PBT criteria. Based on a weight of evidence, bioaccumulation of Sb is considered to be below the B criterion.
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Inherently persistent, not B.** Bioaccumulation assessment based on weight of evidence
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	Harmonised classification for diantimony trioxide indicates does not meet the criteria
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**		WHO (2003)	The WHO report outlining the drinking water guideline for antimony notes that Antimony (III) may show genotoxic effects in vivo and in vitro but limited detail is provided. This may need consideration in the future.
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Not categorised as equivalent to PBT or vPvB, no other toxicological effects leading to equivalent concern according to the criteria.** Sb(III) and Sb(V) salts have similar hazard profile (viz classification of trichloride and pentachloride salts). As noted above the WHO have noted that Antimony (III) may show genotoxic effects in vivo and in vitro but limited details are given. This may need consideration in the future.

Does substance have breakdown products of concern? **No**

REFERENCES

EU Risk Assessment Report (2008)- Draft - Diantimony trioxide. Sweden. http://echa.europa.eu/documents/10162/553c71a9-5b5c-488b-9666-adc3af5cdf5f

ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database?p_p_id=clinventory_WAR_clinventoryportlet&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-

Environment Canada. (2010) Canadian screening assessment diantimony trioxide. http://www.ec.gc.ca/ese-ees/9889ABB5-3396-435B-8428-F270074EA2A7/batch9_1309-64-4_en.pdf

WHO (2003) http://www.who.int/water_sanitation_health/dwq/chemicals/antimony.pdf

	Arsenic as inorganic arsenic (III) and arsenic (V). The (III) and (V) valence states are reported to be the most common forms of arsenic in the environment			
	Yes / No / Insuffcient data / Borderline / assume yes or no?	**Value**	**Reference**	**Comments**
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegredation test	Test not applicable for metals/inorganics			
Passes inherent biodegredation test	Test not applicable for metals/inorganics			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Degradation testing not applicable for metals/inorganics			
Half life fresh or estuarine water ≥ 40 days	See above			
Half life marine sediment ≥ 180 days	See above			
Half life fresh or estuarine sediment ≥ 120 days	See above			
Half life in soil ≥ 120 days	See above			
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)				
Is substance persistent?	**Yes**			**The persistence criteria are not directly applicable to metals/inorganics and were developed principally for organic substances. Metals and inorganics such as arsenic are inherently persistent and subject to transformation rather than degradation. Arsenic will therefore not degrade but will be transformed depending on the local conditions.**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	4 - 1120	Environment Agency (2007)	
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Log Kow values are not applicable to metals			Log Kow values are not considered reliable estimates of the bioaccumulation potential of inorganic substances such as arsenic.
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not considered due to above data			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative *If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained*				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.005mg/l	Environment Agency (2007)	26d NOEC for Daphnia pulex
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	A formally agreed C&L classification has been undertaken for arsenic and some arsenic compounds, ie arsenic trioxide and arsenic pentoxide. In addition a number of industry classifications have been undertaken. The classifications do not indicate it meets the criteria for STOT RE1 or RE2
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Carc 1A	ECHA C&L database	A formally agreed C&L classification has been undertaken for arsenic and some arsenic compounds, ie arsenic trioxide and arsenic pentoxide. In addition a number of industry classifications have been undertaken. The classifications for some inorganic arsenic compounds indicates it is classified as Carc 1A
If answer to any question is YES, substance is toxic *If answer to all questions is NO, substance is not toxic*				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			**Based on chronic toxicity to aquatic life and Carc 1A**
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet criteria for B**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Degradation testing not applicable for metals/inorganics			**The persistence criteria are not directly applicable to metals/inorganics and were developed principally for organic substances. Metals and inorganics such as arsenic are inherently persistent and subject to transformation rather than degradation. Arsenic will therefore not degrade but will be**
Half life in marine, fresh or estuarine sediment ≥ 180 days	See above			
Half life in soil ≥ 180 days	See above			
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	4 - 1120	Environment Agency (2007)	
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Does not meet criteria for vB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	Yes (see comment)		ECHA C&L database/COT (2006)	A formally agreed harmonised EU C&L classification has been undertaken arsenic and some arsenic compounds, ie arsenic trioxide and arsenic pentoxide. In addition a number of industry classifications have been undertaken. The classifications do not indicate it classification as Muta 1A, 1B or 2. Arsenic and arsenic compounds have been designated as a Carc 1 carcinogen by IARC. The UK COT (2006) concluded that inorganic arsenic is genotoxic and a known carcinogen. No threshold has been identified for cancer and current UK health advice is therefore that exposure should be as low as reasonably practicable (ALARP).
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**Yes**			***Does not meet criteria for mutagenic however it has been noted to be genotoxic and that a threshold can not be identified for cancer. COT have proposed that exposure should be as low as reasonably practicable. As a result it meets the criterion relating to a non-threshold chemical***
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			***Meets the criteria for a non-threshold substance due to its carcinogenic properties.***

Does substance have breakdown products of concern? **No**

REFERENCES

Committee on Toxicity of Chemicals in food (2006)	http://cot.food.gov.uk/sites/default/files/cot/cotstatementtds200808.pdf
Committe on Toxicity of Chemicals in Food (2009)	http://cot.food.gov.uk/sites/default/files/cot/tox200940.pdf
European Food Safety Authority Scientific opinion on arsenic in food (EFSA 2010).	http://www.efsa.europa.eu/en/efsajournal/pub/1351.htm
Environment Agency (2007) Proposed EQS for arsenic	https://www.wfduk.org/sites/default/files/Media/arsenic.pdf
ECHA C&L database	http://echa.europa.eu/information-on-chemicals/cl-inventory-database?p_p_id=clinventory_WAR_clinventoryportlet&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-1&p_p_col_pos=1&p_p_col_count=2&_clinventory_WAR_clinventoryportlet_searching=true&_clinventory_WAR_clinventoryportlet_jspPage=%2Fhtml%2Fview.jsp

Benzene (CAS: 71-43-2)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	Yes		EU RAR (2008)	Conflicting results in OECD 301 tests. 301 F several positive results. Overall, considered readily biodegradable.
Passes inherent biodegradation test	Yes	90% (6 days)	EU RAR (2008)	OECD 302 Zahn Wellens. Benzene is inherently biodegradable
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	No data			
Half life fresh or estuarine water ≥ 40 days	No	15	EU RAR (2008)	RAR noted that the available degradation data was very variable with some studies reporting no degradation and others complete mineralisation. The value of 15days was used in the risk assessment and was estimated based on ready biodegradability result. Benzene is noted to volatilise from water and is noted to be a key removal process from surface water. This fate process is not as relevant for groundwater however.
Half life marine sediment ≥ 180 days	No data			
Half life fresh or estuarine sediment ≥ 120 days	Yes	300	EU RAR (2008)	Estimated value
Half life in soil ≥ 120 days	No	30	EU RAR (2008)	Estimated value
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**No**		EU RAR (2008)	Benzene is readily biodegradable; long half-lves in sediment are likely due to bioavailability issues and low inoculum concentrations/diversity
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	13	EU RAR (2008)	The value of 13 was that selected for use in the EU risk assessment but all fish studies showed BCF <100
Does field data show evidence for biomagnification?	No data			
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	2.13	EU RAR (2008)	
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed due to the above information			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	0.8 mg/L	EU RAR (2008)	Fish Early Life Stage study with Pimephales promelas. Lower value in rainbow trout embryos available, but uncertain reliability
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	Yes	STOT RE1	ECHA C&L database	EU harmonised C&L classification available for benzene which indicates it meets the criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Carc. 1A, Muta 1B	ECHA C&L database	EU harmonised C&L classification available for benzene which indicates it meets the criteria
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**	STOT RE1 , Carc. 1A, Muta 1B		Meets the criteria for toxicity based on STOT RE1, Carc 1A, Muta 1B classifications
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet criteria for P or B**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	No	15	EU RAR (2008)	See comments above
Half life in marine, fresh or estuarine sediment ≥ 180 days	Yes	300	EU RAR (2008)	See comments above
Half life in soil ≥ 180 days	No	30	EU RAR (2008)	See comments above
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	13	EU RAR (2008)	The value of 13 was that selected for use in the EU risk assessment but all fish studies showed BCF <100
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Not P or B**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not Assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not Assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not Assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not Assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	Not Assessed			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	Yes	Muta 1B	ECHA C&L database	EU harmonised C&L classification available for benzene which indicates it meets the criteria for mutagenicity
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**Yes**	**Muta 1B**		
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**Meets criteria for Very Toxic due to its mutagenic properties**

Does substance have breakdown products of concern? **No**

REFERENCES

ECHA-C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/cl-inventory/view-notification-summary/127390

EU RAR (2008). EU Risk assessment Report - Benzene http://echa.europa.eu/documents/10162/be2a96a7-40f6-40d7-81e5-b8c3f948efc2

Polyaromatic Hydrocarbons (PAHs):
Benzo-a-pyrene (B(a)P) (CAS-No. 50-32-8)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	No	Not readily biodegradable	ECHA (2010)	OECD301C studies
Passes inherent biodegradation test	No data			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days Half life fresh or estuarine water ≥ 40 days Half life marine sediment ≥ 180 days Half life fresh or estuarine sediment ≥ 120 days	Yes			No specific degradation half life data was provided but generally noted to be slow degradation
Half life in soil ≥ 120 days	Yes	120-258 days	ECHA (2009) & (2010)	
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**		ECHA (2009) & (2010)	An assessment of B(a)P for the EU notes that it is considered to meet the criteria for Persistence and Very Persistent (see below)
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	608 - 191000	ECHA (2009), ECHA (2010); Bleeker and Verbruggen	Substance is generally rapidly metabolised in fish and most of the BCFs for fish were <2000, but may accumulate in some crustacea (BCF 191000 mollusc species; BCF 73000 crustacean species).
Does field data show evidence for biomagnification?	No		ECHA 2009;REACH annex XV dossier; Bleeker and Verbruggen	Biomagnification may occur in lower trophic levels, but biodilution in fish and some invertebrates able to metabolise the substance. Overall, not a bio or trophically magnifying substance.
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Yes	6.5	ECHA 2010	Value of 6.5 noted in ECHA (2010) with values of 5.97 - 6.13 noted in the CIS document
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not assessed due to the available BCF and log Kow data			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative *If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained*				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**Yes**		ECHA (2009) & (2010)	An assessment of B(a)P for the EU notes that it is considered to meet the criteria for Bioaccumulation and Very Bioaccumulative (see below)
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.0005 mg/l	ECHA (2010)	7d EC10 (repro) Ceriodaphnia with standard lighting conditions; 0.00078 mg/l algae ErC10 (Pseudokirchneriella subcapitata) with UV light; Fish 6.3 ug/L (0.0063 mg/L)
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA CLP database	EU harmonised classification available for B(a)P which indicates it does not meet the criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Carc 1B, Muta 1B. Repr 1B	ECHA CLP database	EU harmonised classification available which indicates it does meet the criteria
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			**Meets criteria for chronic aquatic toxicity and also noted as Carc 1B, Muta 1B and Repr 1B**
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**Yes**		ECHA (2009) & (2010)	An assessment for the EU have noted that benzo(a)pyrene meets the criteria for PBT
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days Half life in marine, fresh or estuarine sediment ≥ 180 days Half life in soil ≥ 180 days	Yes	See above		
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	Yes	See above		
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**Yes**		ECHA (2009) & (2010)	An assessment for the EU have noted that benzo(a)pyrene meets the criteria for vPvB
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	Not assessed			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	Yes	Muta 1B	ECHA CLP database	EU harmonised C&L classification available which indicates meets the criteria for mutagenicity
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**Yes**			**Meets the criteria for mutagenicity**
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**Meets criteria for P, B and T. Also 'Very Toxic' as Muta 1B and meets criteria for vPvB** **Benzo(a)pyrene has been noted at an EU level to be PBT and vPvB (ECHA (2009) and (2010))**
Does substance have breakdown products of concern?	**No**			

REFERENCES

CIS Substance Data Sheet - PAHs https://circabc.europa.eu/sd/a/996c9804-30c4-4ea1-b16d-3cbc571b2bac/28_PAH_EQSdatasheet_310705.pdf
ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-
ECHA REACH Annex XV dossier (2010) http://www.reach-clp-biozid-helpdesk.de/de/Downloads/PAK-Dossier-PAK.pdf?__blob=publicationFile&v=2
ECHA 2009 (SVHC dossier for coal tar pitch) http://echa.europa.eu/documents/10162/8b23ff02f-452d-459b-a043-76cba8104dbe
Bleeker and Verbruggen http://www.rivm.nl/en/Documents_and_publications/Scientific/Reports/2010/maart/Bioaccumulation_of_polycyclic_aromatic_hydrocarbons_in_aquatic_organisms?sp=cml2bXE9Z

Benzo-b-fluoranthene (CAS: 205-99-2)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	Insufficient data			
Passes inherent biodegradation test	Insufficient data			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Yes	42-125days	ECHA (2010)	Estimated degradation half lives for water noted in ECHA (2010). PAHs can undergo photolysis but not considered to be a significant pathway as only operates in top few cm of water column; PAHs with 4 or more rings undergo little biodegradation in water (ECHA 2009)
Half life fresh or estuarine water ≥ 40 days	Insufficient data			
Half life marine sediment ≥ 180 days	Insufficient data			
Half life fresh or estuarine sediment ≥ 120 days	Yes	42 - 1250	ECHA (2010)	Estimated half lives in sediment noted in ECHA (2010). PAHs with 4 or more rings undergo very slow biodegradation in aquatic sediments (ECHA 2009)
Half life in soil ≥ 120 days	Yes	113-282 days	ECHA 2009	Estimated half lives of 420 - 1250days noted in ECHA (2010)
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**		**ECHA (2009) and (2010)**	**Agreed vP at EU level along with a number of other PAHs**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	2800	HSDB	The BCF value of 2800 is reported for clams. No experimentally derived BCFs are noted in the ECHA (2009) and (2010) documents. The latter noted that on the basis of similarities of their Kow values and molecular sizes with other PAHs for which BCFs above the bioaccumulation criteria have been experimentally confirmed, it is anticipated that BCF values for this substance will be >2000. PAHs are generally rapidly metabolised in fish but accumulate in crustacea and molluscs.
Does field data show evidence for biomagnification?	No Data			PAHs are known to biomagnify in lower trophic levels, but biodilute in fish and some invertebrates able to metabolise the substance.
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Yes	6.12	ECHA (2009) & (2010)	Estimated; ClogP model
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed due to the availability of the above info			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**Yes**			Based on the weight of evidence have noted that it meets the criteria for Persistence. The ECHA 2009 report noted that there was insufficient experimental data to determine whether it met B
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Insufficient Data		ECHA (2009) and (2010)	No chronic effect concentrations were located. EHCA (2010) notes that no effects were observed on aquatic lfie at concentrations up to the water solubility of benzo(No effects up to limit of water solubility in available chronic studies
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	EU harmonised C&L classification for benzo(b)fluoranthene indicates it does not meet the criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Carc. 1B	ECHA C&L database	EU harmonised C&L classification for benzo(b)fluoranthene indicates it meets the criteria for mutagenicity
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**Yes**			**Data indicates meets the criteria for persistence, bioaccumulation and toxicity. The EU SVHC report did not note that benzo(b)fluoranthene met the PBT criteria as it was noted that insufficient experimental data was available for bioaccumulation. Based on the weight of evidence have noted it meets the B criteria in this assessment.**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Insufficient data		ECHA 2009	PAHs can undergo photolysis but not a significant pathway as only operates in top few cm of water column; PAHs with 4 or more rings undergo little biodegradation in water
Half life in marine, fresh or estuarine sediment ≥ 180 days	Insufficient data		ECHA 2009	PAHs with 4 or more rings undergo very slow biodegradation in aquatic sediments
Half life in soil ≥ 180 days	Yes	113-282 days	ECHA 2009	Assumed yes based on upper value
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	Insufficient data			The BCF value of 2800 is reported for clams (HSDB). No experimentally derived BCFs are noted in the ECHA (2009) and (2010) document. The latter noted that on the basis of similarities of their Kow values and molecular sizes with other PAHs for which BCFs above the bioaccumulation criteria have been experimentally confirmed, it is anticipated that BCF values for this substance will be >2000. Although vB is not specifically mentioned based on data for other similar compounds indicates benzo(b)fluoranthene may meet the criteria for vB. PAHs are generally rapidly metabolised in fish but accumulate in crustacea and molluscs.
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**Insufficient data**			**Data indicates vP but insufficient data to determine whether it meets the vB criteria. Based on the available data for similar substances it indicates there is the potential for benzo(b)fluoranthene to meet the criteria for vB however data is insufficient to confirm this.**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	Not assessed			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	EU harmonised C&L classification for benzo(b)fluoranthene indicates it does not meet the criteria for mutagenicity
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**Meets the criteria for persistence, bioaccumulation and toxicity**

Does substance have breakdown products of concern? **No**

REFERENCES

HSDB http://toxnet.nlm.nih.gov/cgi-bin/sis/search2

CIS. 2005. *Substance datasheet - PAH's* https://circabc.europa.eu/sd/a/996c9804-30c4-4ea1-b16d-3cbc571b2bac/28_PAH_EQSdatasheet_310705.pdf

ECHA C&L Database https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/45772

ECHA (2010) http://www.reach-clp-biozid-helpdesk.de/de/Downloads/PAK-Dossier-PAK.pdf?__blob=publicationFile&v=2

ECHA 2009 SVHC report for coal tar pitch http://echa.europa.eu/documents/10162/8b23f02f-452d-459b-a043-76cba8104dbe

Benzo-ghi-perylene (CAS: 191-24-2)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	No data			
Passes inherent biodegradation test	No data			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	No data			
Half life fresh or estuarine water ≥ 40 days	Yes	590-650 days	Databank of Environmental Chemicals; ECHA 2009	PAHs can undergo photolysis but not a significant pathway as only operates in top few cm of water column; PAHs with 4 or more rings undergo little biodegradation in water
Half life marine sediment ≥ 180 days	No data			
Half life fresh or estuarine sediment ≥ 120 days	No data		ECHA 2009	PAHs with 4 or more rings undergo very slow biodegradation in aquatic sediments
Half life in soil ≥ 120 days	Yes	365-535 days	ECHA 2009	
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			**An assessment of benzo(ghi)perylene for the EU (ECHA 2009) notes it is considered to meet the criteria for Persistence**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	28288	ECHA 2009	Measured BCF in Daphnia magna. PAHs are generally rapidly metabolised in fish but accumulate in crustacea and molluscs.
Does field data show evidence for biomagnification?			ECHA 2009	PAHs are known to biomagnify in lower trophic levels, but biodilute in fish and some invertebrates able to metabolise the substance.
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Yes	6.22	ECHA 2009	Measured (slow stir method)
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed due to the availability of the above information			
Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**Yes**			**An assessment of benzo(ghi)perylene for the EU (ECHA 2009) notes it is considered to meet the criteria for Bioaccumulation**
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.0012 mg/L (1.2 ug/L)	CIS	NOEC Freshwater Algae (*Selenastrum capricornutum*)
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	Insufficient Data		ECHA C&L Database	No EU harmonised C&L classification. ECHA C&L database contains very little data for benzo(ghi)perylene and no notifications listed other than aquatic toxicity. By analogy with other PAHs likely to have similar effects although level may differ.
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Insufficient Data		CIS, ECHA C&L Database	No EU harmonised C&L classification. ECHA C&L database contains very little data for benzo(ghi)perylene and no notifications listed other than aquatic toxicity. By analogy with other PAHs likely to have similar effects although level may differ.No information was available to assess the carcinogenicity and reproductive toxicity of this substance. IARC considered that this substance was not classifiable as to its carcinogenicity to humans (Group 3) and that inadequate evidence for the carcinogenicity of this substance was available in experimental animals. The ATSDR toxicity profile for polyaromatic hydrocarbons noted that benzo[g,h,i]perylene had been reported to be mutagenic in S. typhimurium and to cause DNA damage in E. coli. It had also been shown to be responsible for the formation of DNA adducts isolated after topical application of pharmaceutical grade coal tar to the skin of mice (Hughes et al. 1993). In the absence of data to the contrary it would be prudent to regard as potentially mutagenic.
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			*The available aquatic toxicity data indicates it meets the criteria. The data relating to the criteria for human health are more limited. However based on the available data and knowledge of the effects of other PAHs can assume it will meet the criteria for toxicity*
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**Yes**			**Meets criteria for persistence, bioaccumulation and toxicity.** **An assessment for the EU (ECHA 2009) have noted that benzo(ghi)perylene meets the criteria for PBT**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes	590-650 days	Databank of Environmental Chemicals	PAHs can undergo photolysis but not a significant pathway as only operates in top few cm of water column; PAHs with 4 or more rings undergo little biodegradation in water
Half life in marine, fresh or estuarine sediment ≥ 180 days	No data		ECHA 2009	PAHs with 4 or more rings undergo very slow biodegradation in aquatic sediments
Half life in soil ≥ 180 days	Yes	365-535 days	ECHA 2009	
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	Yes	28288	ECHA 2009	Measured BCF in Daphnia magna. PAHs are generally rapidly metabolised in fish but accumulate in crustacea and molluscs.
If answer is ves. substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**Yes**	**Yes**		**An assessment for the EU have noted that benzo(ghi)perylene meets the criteria for vPvB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	Insufficient Data (but see comments)		ECHA C&L Database	No EU harmonised classification. ECHA C&L database contains very little data for benzo(ghi)perylene and no notifications listed other than aquatic toxicity. By analogy with other PAHs likely to have similar effects although level may differ. The ATSDR toxicity profile for polyaromatic hydrocarbons noted that benzo[g,h,i]perylene had been reported to be mutagenic in S. typhimurium and to cause DNA damage in E. coli. It had also been shown to be responsible for the formation of DNA adducts isolated after topical application of pharmaceutical grade coal tar to the skin of mice (Hughes et al. 1993). In the absence of data to the contrary it would be prudent to regard as potentially mutagenic.
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	No			
Is substance very toxic?	**Insufficient data (see comments)**			**Insufficient data is available to make an assessment of the mutagenicity of benzo(ghi)perylene. The fact the available data indicates it meets the criteria for P, B and T means that it is deemed Hazardous based on those properties**
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**Benzo(ghi)perylene has been noted at an EU level to be PBT and vPvB (ECHA 2009).**

Does substance have breakdown products of concern? **No**

REFERENCES

Toxnet

CIS. 2005. Substance Datasheet - PAH's https://circabc.europa.eu/sd/a/996c9804-30c4-4ea1-b16d-3cbc571b2bac/28_PAH_EQSdatasheet_310705.pdf

Databank of Environmental Chemicals https://wwwp.ymparisto.fi/scripts/Kemrek/Kemrek.asp?Method=MAKECHEMSEARCHFORM

ECHA C&L Database https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/15793

ECHA 2009 SVHC report for coal tar pitch http://echa.europa.eu/documents/10162/8b23f02f-452d-459b-a043-76cba8104dbe

ATSDR http://www.atsdr.cdc.gov/toxprofiles/tp69.pdf

IARC http://monographs.iarc.fr/ENG/Monographs/vol92/mono92-10.pdf

Benzo-k-fluoranthene (CAS: 207-08-9)				
	Yes / No / Insufficent data / Borderline / assume yes or no?	**Value**	**Reference**	**Comments**
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test Passes inherent biodegradation test	Insufficient Data			
If answer to either question is YES, substance is not persistent *If answer to both questions is NO, additional data on half life is required*				
Half life marine water ≥ 60 days Half life fresh or estuarine water ≥ 40 days Half life marine sediment ≥ 180 days	Yes	42-125days	ECHA 2010	Estimated half lives of 42-125days were noted in the ECHA (2010) report. PAHs can undergo photolysis but not a significant pathway as only operates in top few cm of water column; PAHs with 4 or more rings undergo little biodegradation in water (ECHA, 2009)
Half life fresh or estuarine sediment ≥ 120 days	Yes	>1250 days	ECHA 2010	Estimated half lives of >1250dyas were noted in ECHA (2010) report. PAHs with 4 or more rings undergo very slow biodegradation in aquatic sediments (ECHA, 2009)
Half life in soil ≥ 120 days	Yes	143-359 days	ECHA 2009	Estimated half lives of 420 - 1250days were reproted in ECHA (2010)
If answer to any question is YES, substance is persistent *If answer to all questions is NO, substance is not persistent*				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**		**ECHA (2009) and (2010)**	**An assessment of benzo(k)fluoranthene for the EU (ECHA 2009)(ECHA 2010) notes that it is considered to meet the criteria for Persistence**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	13225	ECHA (2009) and (2010)	BCF in a crustacean species. PAHs are generally rapidly metabolised in fish but accumulate in crustacea and molluscs.
Does field data show evidence for biomagnification?				PAHs are known to biomagnify in lower trophic levels, but biodilute in fish and some invertebrates able to metabolise the substance.
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Yes	6.84	ECHA (2010)	Supported by a value of 6.11 noted in ECHA (2009)
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed due to the availability of the above information			
Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative *If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained*				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes	Yes		
Is substance bioaccumulative?	**Yes**	**Yes**	**ECHA 2009**	**An assessment of benzo(k)fluoranthene for the EU (ECHA 2009) notes that it is considered to meet the criteria for Bioaccumulation**
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.17 ug/L	ECHA (2010), EU (2011)	Chronic EC10 value for the fish Brachydanio rerio with an EC10 for effect on length of 0.17ug/l reported
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No	-	ECHA C&L Database	EU harmonised C&L classification indicates it does not meet these criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Carc 1B	ECHA C&L database; CIS	EU harmonised C&L classification indicates it meets the criteria for Carc 1B
If answer to any question is YES, substance is toxic *If answer to all questions is NO, substance is not toxic*				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			Meets the criteria for chronic aquatic toxicity and carcingoenicity
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**Yes**			**Meets criteria for persistence, bioaccumulation and toxicity** **An assessment for the EU (ECHA 2009) have noted that benzo(k)fluoranthene meets the criteria for PBT**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes	42-125days	ECHA 2010	Estimated half lives of 42-125days were noted in the ECHA (2010) report. PAHs can undergo photolysis but not a significant pathway as only operates in top few cm of water column; PAHs with 4 or more rings undergo little biodegradation in water (ECHA, 2009)
Half life in marine, fresh or estuarine sediment ≥ 180 days	Yes	>1250 days	ECHA 2010	Estimated half lives of >1250dyas were noted in ECHA (2010) report. PAHs with 4 or more rings undergo very slow biodegradation in aquatic sediments (ECHA, 2009)
Half life in soil ≥ 180 days	Yes	143-359 days	ECHA 2009	Estimated half lives of 420 - 1250days were reproted in ECHA (2010)
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	Yes	13225	ECHA 2009	BCF in a crustacean species
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**Yes**			**An assessment for the EU (ECHA 2009 and 2010) have noted that benzo(k)fluoranthene meets the criteria for vPvB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	Not assessed			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No	-	ECHA C&L database	EU harmonised C&L classification for benzo(k)fluoranthene indicates it does not meet these criteria
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**Meets criteria for persistence, bioaccumulation and toxicity and for vP and vB (ECHA, 2009 and 2010)**

Does substance have breakdown products of concern? **No**

REFERENCES

EU (2011) EQS dossier https://circabc.europa.eu/sd/a/4e13a4c4-07b9-4e55-a43d-823e7cd4ce82/PAH%20EQS%20dossier%202011.pdf
ECHA 2009 SVHC report for coal tar pitch http://echa.europa.eu/documents/10162/8b23f02f-452d-459b-a043-76cba8104dbe
Databank of Environmental Chemicals http://wwwp.ymparisto.fi/scripts/Kemrek/Kemrek_uk.asp?Method=MAKECHEMdetailsform&txtChemId=1775
ECHA C&L Database https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/58814
ECHA (2010) http://www.reach-clp-biozid-helpdesk.de/de/Downloads/PAK-Dossier-PAK.pdf?__blob=publicationFile&v=2

Boron (as boron (III))

The most commonly occurring inorganic boron compounds are as Boron (III) and include boron oxides, sulphides and halides as well as borate salts such as sodium borate (borax). Commonly found boron compounds include sodium borate (borax), boric acid, sodium perborate, boron oxide. The majority of boron (III) compounds are soluble in water with the most common forms in water being boric acid and borate ion.

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	Test not applicable for metals/inorganics			
Passes inherent biodegradation test	See above			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Degradation testing not applicable for metals/inorganics			
Half life fresh or estuarine water ≥ 40 days	See above			
Half life marine sediment ≥ 180 days	See above			
Half life fresh or estuarine sediment ≥ 120 days	See above			
Half life in soil ≥ 120 days	See above			
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**		**EHC (1998), ESR (2007), CCME 2009**	**The persistence criteria are not directly applicable to metals/inorganics and were developed principally for organic substances. Metals and inorganics such as boron are inherently persistent and subject to transformation rather than degradation. Boron will therefore not degrade but will be transformed, with the most common forms present in the freshwater environment being boric acid and borates.**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	0.3	ESR (2007)	Data collated for boric acid and borate indicate boron does not have a high potential to bioaccumulate in aquatic organisms
Does field data show evidence for biomagnification?	No		ESR (2007)	Although boron was found to be incorporated into plant cell walls it is not considered to biomagnify in the food chain and it is noted that levels of boron are found to decrease in higher trophic level organisms
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Log Kow values are not applicable to metals			Log Kow are not considered reliable estimates of the potential for bioaccumulation of inorganic substances such as boron. Log Kow values have been reported for boric acid and borax (-1.09 and -1.53 respectively) but are not considered reliable indicators of bioaccumulation.
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not considered due to above information			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	1mg/l	CCME 2009	*Elodea canadensis* NOEC. The lowest data for a fish species was a 87day NOEC for *Onchorhynchus mykiss* of 2.1mg/l
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	Classifications have been made for a number of boron compounds. Those of key relevance here including boric acid, boron oxide, sodium borate indicate that this criterion is not met, ie not STOT RE1 or RE2
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Repr 1B	ECHA C&L database	Classifications have been made for a number of boron compounds. Those of key relevance here including boric acid, boron oxide, sodium borate indicate that this criterion is met, ie Repr 1B
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			**Based on Repr 1B**
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet the criteria for B**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	See comment			
Half life in marine, fresh or estuarine sediment ≥ 180 days	See comment			
Half life in soil ≥ 180 days	See comment			**The persistence criteria are not directly applicable to metals/inorganics and were developed principally for organic substances. Metals and inorganics such as boron are inherently persistent and subject to transformation rather than degradation. Boron will therefore not degrade but will be transformed, with the most common forms present in the freshwater environment being boric acid and borates.**
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	0.3	ESR (2007)	Data collated for boric acid and borate indicate boron does not have a high potential to bioaccumulate in aquatic organisms
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Does not meet the criteria for vB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	Classifications have been made for a number of boron compounds. Those of key relevance here including boric acid, boron oxide, sodium borate indicate that this criterion is not met.
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Does not meet criteria for P, B and T nor vPvB or Very Toxic**
Does substance have breakdown products of concern?	**No**			

REFERENCES

ECHA C&L database	http://echa.europa.eu/information-on-chemicals/cl-inventory-database
CCME (2009)	http://www.google.co.uk/url?url=http://ceqg-rcqe.ccme.ca/download/en/324/&rct=j&frm=1&q=&esrc=s&sa=U&ei=rFjjU7DIN-iw0QWTv4GgCw&ved=0CCsQFjAD&usg=AFQjCNFx_KZZBZoKUmrMyDVkWJHRsTOlgg
EHC (1998)	http://www.inchem.org/documents/ehc/ehc/ehc204.htm
ESR (2007)	http://echa.europa.eu/documents/10162/679ddd86-ab61-42cb-8bc2-0a8078ba007f

	Cadmium as cadmium (II) Cadmium (II) ions and compounds are commonly found in the freshwater environment. Even relatively insoluble Cd (II) compounds have been found to release the toxic			
	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegredation test	Test not applicable for metals/inorganics			
Passes inherent biodegredation test	See above			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Degradation testing not applicable for metals/inorganics			
Half life fresh or estuarine water ≥ 40 days	See above			
Half life marine sediment ≥ 180 days	See above			
Half life fresh or estuarine sediment ≥ 120 days	See above			
Half life in soil ≥ 120 days	See above			
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)				
Is substance persistent?	**Yes**			**Persistence criteria were developed for organics. Metals and inorganics such as cadmium (II) are inherently persistent, subject to transformation rather than degradation.**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	229 and 994	ESR (2007)	These values are the median BCF values for invertebrates and fish respectively based on data collated for the ESR. The value for algae is much higher 7535 however it may be due to adsorption and not accumulation
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Log Kow values are not applicable to metals			Log Kow values are not considered a reliable approach for assessing the potential for inorganic substances such as cadmium to bioaccumulate.
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not assessed due to the above information			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.0008mg/l	ESR (2007)	21d NOEC for the invertebrate Daphnia magna. Other studies on inverebrates and fish showed effect concentrations below the criterion of <0.01mg/l.
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	Yes	STOT RE1	ECHA C&L database	A number of cadmium (II) compounds have been classified under C&L and have been determined as STOT RE1
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Muta 1B, Carc 1B, Repr 1B	ECHA C&L database	A number of cadmium (II) compounds have been classified under C&L and have been determined as Muta 1B or 2, Carc 1B and Repr 1B and 2.
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			**STOT RE1 but also Muta,Carc and Repr 1B. Also meets criteria for chronic aquatic toxicity**
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet the criteria for bioaccumulation**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	See comment			Persistence criteria were developed for organics. Metals and inorganics such as cadmium (II) are inherently persistent, subject to transformation rather than degradation.
Half life in marine, fresh or estuarine sediment ≥ 180 days	See comment			
Half life in soil ≥ 180 days	See comment			
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	229 and 994	ESR (2007)	These values are the median BCF values for invertebrates and fish respectively based on data collated for the ESR. The value for algae is much higher 7535 however it may be due to adsorption and not accumulation
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Does not meet criteria for vB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	Yes	Muta 1B	ECHA C&L database	A number of cadmium (II) compounds have been classified under C&L and have been determined as Muta 1B or 2. *(See comment below)*
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No (see comment)**		WHO (2011)	Although classified as Muta 2 under C&L the WHO (2011) have derived a threshold for cadmium for drinking water. They note that there is limited evidence for genotoxic effects via the oral route. It is not considered as a non-threshold substance for genotoxic effects hence why it has not been classified as Very Toxic
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Does not meet the criteria for P, B, T due to the criteria for bioaccumulation not being met. Although classed as Muta 2 under C&L WHO (2011) noted there is limited evidence for genotoxic effects via the oral route and it is not considered to be a non-threshold substance for genotoxic effects and therefore not considered to meet the criteria for Very Toxic.**
Does substance have breakdown products of concern?	**No**			

REFERENCES

ECHA C&L database https://echa.europa.eu/information-on-chemicals/cl-inventory-database?p_p_id=clinventory_WAR_clinventoryportlet&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=
EU (2007) ESR risk assessment on cadmium oxide http://echa.europa.eu/documents/10162/66b725c2-0bb5-483d-8557-a4069be0d681
WHO (2011) http://www.who.int/water_sanitation_health/dwq/chemicals/cadmium.pdf

Chloroalkanes C10-13 (CAS: 85535-84-8)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	No		ECHA SVHC report (2008a)	A ready biodegradability study, using the OECD 301C method, which was assessed in the ECHA report indicated it did not meet the criteria for ready biodegradability
Passes inherent biodegradation test	No		ECHA SVHC report (2008a)	An inherent biodegradability study assessed in the ECHA report indicated it did not meet the criteria for inherent biodegradability (basedon OECD 302).
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	No data		ECHA SVHC report (2008a)	The ECHA SVHC report noted no reliable half life data was available for water
Half life fresh or estuarine water ≥ 40 days	No data		ECHA SVHC report (2008a)	See above
Half life marine sediment ≥ 180 days	Yes	450days	ECHA SVHC report (2008b)	The ECHA SVHC decision document notes that aerobic degradation half life of 335days noted in marine sediment for C10 and 680days for C13. The report notes that if a mean half life is calculated this is assumed to be representative of half life for C10-13. This mean value is 450days.
Half life fresh or estuarine sediment ≥ 120 days	Yes	1630days	ECHA SVHC report (2008b)	The ECHA SVHC decision document notes that aerobic degradation half life of 1340days noted in freshwater sediment for C10 and 1790days for C13. The report notes that if a mean half life is calculated this is assumed to be representative of half life for C10-13. This mena value is 1630days.
Half life in soil ≥ 120 days	No data		ECHA SVHC report (2008a)	The ECHA SVHC report noted no reliable half life data was available for soil.
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			**Chloroalkanes C10-13 are noted to meet the P criteria following assessment under REACH. SCCPs have also been classified as Persistent Organic Pollutant (POP).**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	7816	ECHA SVHC report (2008b, 2008a)	Measured BCF in fish. High concentrations have been found in other species including whales and seals
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Yes	4.39 - 8.69	ECHA SVHC report (2008a)	A range of Log Kow values have been reported with the value being influenced by the chlorine content.
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not assessed due to above data			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**Yes**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.005mg/l	ECHA SVHC report (2008b)	The ECHA SVHC decision document notes that the lowest NOEC reported was a 21d NOEC Daphnia magna of 0.005mg/l.
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	The EU harmonised classification indicates chloroalkanes C10-13 are not classified as STOT RE1 or RE2
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database	The EU harmonised classification indicates chloroalkanes C10-13 are classified as Carc 2 only and therefore does not meet this criterion.
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**	**Based on chronic aquatic toxicity data**		
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**Yes**			**Short chain chloroalkanes have been noted as PBT following review for SVHC under REACH (ECHA, 2008b). In addition this group of chemicals have been classified as POPs.**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	No data		ECHA SVHC report (2008a)	It was noted no reliable half life data was available for water
Half life in marine, fresh or estuarine sediment ≥ 180 days	Yes	1630days	ECHA SVHC report (2008b)	The ECHA SVHC decision document notes that aerobic degradation half life of 1340days noted in freshwater sediment for C10 and 1790days for C13. The report notes that if a mean half life is calculated this is assumed to be representative of half life for C10-13. This mena value is 1630days.
Half life in soil ≥ 180 days	No data		ECHA SVHC report (2008a)	It was noted no reliable half life data was available for soil
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	Yes	7816	ECHA SVHC report (2008b)	Measured BCF in fish
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**Yes**	**Meets criteria for vPvB**		**Short chain chloroalkanes have been noted as vPvB following review for SVHC under REACH (ECHA, 2008b). In addition this group of chemicals has been classified as POPs under the Stockholm Convention**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	The EU harmonised classification for chloroalkanes C10-13 indicates it is not classified as mutagenic.
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**	**The available data indicates it meets the criteria for PBT and vPvB**		**Short chain chloroalkanes have been noted as PBT and vPvB following review for SVHC under REACH. In addition this group of chemicals has been classified as Persistent Organic Pollutant (POP) under the Stockholm Convention.**
Does substance have breakdown products of concern?	**No**			

REFERENCES

EU Risk Assessment Report (2008) http://echa.europa.eu/documents/10162/c157d3ab-0ba7-4915-8f30-96427de56f84
ECHA SVHC decision document (2008b) https://echa.europa.eu/documents/10162/6e360a76-2cea-49b3-aabb-ceabf4cfb79b
ECHA SVHC support document (2008a) https://echa.europa.eu/documents/10162/2edcfedb-ec53-4754-8598-e787a8ff7a58
ECHA C&L database https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/95019

	Chromium VI ion (18540-29-9), including soluble/dissociating Cr(VI) salts (chromium trioxide (1333-82-0), sodium chromate (7775-11-3), sodium dichromate (10588-01-9), ammonium dichromate (7789-09-5), potassium dichromate (7778-50-9))			
	Yes / No / Insufficent data / Borderline / assume yes or no?	**Value**	**Reference**	**Comments**
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	Test not applicable for metal/inorganic			
Passes inherent biodegradation test	See above			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Degradation testing not applicable for metal/i			
Half life fresh or estuarine water ≥ 40 days	See above			
Half life marine sediment ≥ 180 days	See above			
Half life fresh or estuarine sediment ≥ 120 days	See above			
Half life in soil ≥ 120 days	See above			
Other relevant information (e.g. dissolution/transformation for metals/inrganics)	Cr (VI) is the most relevant form for groundwater. Cr(VI) can react with a wide range of reducing agents to form Cr(III), depending on conditions (pH, redox potential) and presence of suitable reducing agent -half life is site & environment specific. For acidic (or neutral where high concentrations of reducing agents exist) soils, sediments and waters Cr(VI) is rapidly reduced to Cr(III) but 3% will be oxidised back to Cr(VI). Under			
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			**Persistence criteria were developed for organics. Metals and inorganics such as chromium (VI) are inherently persistent, subject to transformation rather than degradation.**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	1	EU RAR (2005)	BCF result noted relates to fish. BCF data indicates low potential to bioaccumulate
Does field data show evidence for biomagnification?	No data			
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Log Kow values are not applicable to metals			Log Kow are not considered reliable estimates of the potential for bioaccumulation of inorganic substances such as chromium (VI).
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not assessed due to the information above			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.0047	EU RAR (2005)	Lowest 7 day NOEC = 4.7ug/l (Ceriodaphnia dubia), lowest 21 day NOEC = 18ug/l (Daphnia magna)
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	Yes	STOT RE1	ECHA C&L database	Based on EU harmonised C&L classifications for a number of Cr(VI) compounds as identified above
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Carc 1B, Muta 1B, Repr 1B	ECHA C&L database	Majority of the studies used were based on inhalation; oral route information not sufficient (see notes below re: mutagenicity)
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Inherently P, meets criteria for T, but not B**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	See comment			**Persistence criteria were developed for organics. Metals and inorganics such as chromium (VI) are inherently persistent, subject to transformation rather than degradation.**
Half life in marine, fresh or estuarine sediment ≥ 180 days	See comment			
Half life in soil ≥ 180 days	See comment			
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	1	EU RAR (2005)	BCF result noted relates to fish. BCF data indicates low potential to bioaccumulate
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Inherently P, does not meet criteria for vB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	Yes	Muta. 1B	ECHA C&L database	Chromium VI trioxide EU harmonised C&L classification and C&L classifications for the other CrVI identified above indicate Muta 1B. The UK Committee for Mutagenicity (COM) (2012) stated that chromium VI compounds are mutagenic and it is not possible to assume that there is a level at which there is no cancer risk. WHO (2003) note that because of the carcinogenicity of chromium(VI) by the inhalation route and its genotoxicity, the current drinking water guideline value of 0.05 mg/litre has been questioned, but the available toxicological data do not support the derivation of a new value. As a practical measure, 0.05 mg/litre, which is considered to be unlikely to give rise to significant risks to health, has been retained as a provisional guideline value until additional information becomes available and chromium can be re-evaluated. The opinion formed by COM however that there is no assumed threshold for chromium (VI) however is still in place however until there is a UK expert committee view to the contrary and there considered appropriate in this assessment.
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**Yes**	**Muta 1B**		
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**	**Mutagenic**		The determination of Cr(VI) as Hazardous takes into account the available data and guidance given by a range of organisations. It is acknowledged that different opinions exist on Cr(VI). The determination of Cr(VI) as Hazardous is based on the decision to be consistent with the current UK position on Cr(VI) as set out by the UK Committee for Mutagenicity (COM) (2012) which states that Cr(VI) compounds are mutagenic and so it is not possible to assume there is a level at which there is no cancer risk.
Does substance have breakdown products of concern?	**No**			

REFERENCES

EU Risk Assessment Report. 2005. Chromium trioxide, sodium chromate, sodium dichromate, ammonium chromate, http://echa.europa.eu/documents/10162/3be377f2-cb05-455f-b620-af3cbe2d570b

ECHA C&L Database http://echa.europa.eu/information-on-chemicals/cl-inventory-database?p_p_id=clinventory_WAR_clinventoryportlet&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-1&p_p_col_pos=1&p_p_col_count=2&_clinventory_WAR_clinventoryportlet_searching=true&_clinventory_WAR_clinventoryportlet_jspPage=%2Fhtml%2Fview.jsp

WHO 2003 http://www.who.int/water_sanitation_health/dwq/chemicals/chromium.pdf?ua=1

COM (2012) Committee on Mutagenicity Guidance on the significance of chemical-induced mutation for human health https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/315825/humanhealthsignificancefinal.pdf

Cobalt as the Cobalt(II) ion, covering Cobalt (CAS 7440-48-4), Cobalt carbonate (CAS: 513-79-1), cobalt sulfate (CAS 10124-43-3)

The sulfate and carbonate salts readily dissociate to give the dication in solution under normal enivironmental conditions; pH, DOC and hardness will all influence the "available" fraction in solution. In the 7-day OECD transformation/dissolution protocol, cobalt metal released concentrations of Co(II) of 0.3 - 12.78 mg/l at loadings of 1, 10 and 100 mg/l and specific surface areas of 0.127 - 0.65 m2/g. (Env Can)

	Yes / No / Insuffcient data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegredation test	Test not applicable (see comment)			Test not applicable for metals/inorganics
Passes inherent biodegredation test	See above			See above
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Test not applicable (see comment)			Degradation testing not applicable for metals/inorganics
Half life fresh or estuarine water ≥ 40 days	See above			
Half life marine sediment ≥ 180 days	See above			
Half life fresh or estuarine sediment ≥ 120 days	See above			
Half life in soil ≥ 120 days	See above			
Other relevant information (e.g. dissolution/transformation for metals/inrganics)				
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes (See comment)**		**CICAD (2006)**	**The persistence criteria are not directly applicable to metals/inorganics and were developed principally for organic substances. Metals and inorganics such as cobalt are inherently persistent and subject to transformation rather than degradation. Cobalt will therefore not degrade but will be transformed depending on the local conditions.**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	<2000	Environment Canada (2011), EQS (Defra)	Cobalt uptake and accumulation will be regulated in many aquatic organisms and as such will depend on exposure concentrations. A number of studies were reported for invertebrates and fish. Only one study in an invertebrate was above the threshold of 2000; fish studies <2000. Using weight of evidence Co(II) does not meet the criteria for bioaccumulation
Does field data show evidence for biomagnification?	No	<1	Environment Canada (2011)	BMF values were noted as less than 1 which indicates it doesn't biomagnify
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Log Kow not applicable to metals/inorganics			Log Kow is not relevant for inorganic substances such as cobalt and its inorganic salts
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not considered due to above data			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative *If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers). BCF data should be obtained*				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.0055mg/l	Environment Canada(2011)	28d EC10 Hyallela azteca
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	Based on C&L classification for sulfate and carbonate salts on basis of Co(II)
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Reor 1A, 1B, 2)	Yes	Repr 1B, Muta 2	ECHA C&L database	Based on C&L classification for sulfate and carbonate salts on basis of Co(II) (Also noted as Carc 1B but via inhalation)
If answer to any question is YES, substance is toxic *If answer to all questions is NO, substance is not toxic*				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet criteria for B**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Test not applicable (see comment)		**CICADS (2006)**	**The persistence criteria are not directly applicable to metals/inorganics and were developed principally for organic substances. Metals and inorganics such as cobalt are inherently persistent and subject to transformation rather than degradation. Cobalt will therefore not degrade but will be transformed depending on the local conditions.**
Half life in marine, fresh or estuarine sediment ≥ 180 days	As above			
Half life in soil ≥ 180 days	As above			
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	<2000	Environment Canada (2011), EQS (Defra)	Cobalt uptake and accumulation will be regulated in many aquatic organisms and as such will depend on exposure concentrations. A number of studies were reported for invertebrates and fish. Only one study in an invertebrate was above the threshold of 2000; fish studies <2000. Using weight of evidence Co(II) does not meet the criteria for bioaccumulation
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Does not meet criteria for B**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	Yes	Muta 2	ECHA C&L database	The EU harmonised classifications for sulfate and carbonate salts on basis of Co(II) indicate Muta 2. A range of evidence has been considered alongside the C&L classification. A number of reviews of the impact of cobalt have been undertaken by a range of organisations including Environment Canada and OECD. The data on the genotoxic effects of cobalt (II) are varying. A review by the EVM (2003) noted mixed results had been obtained for the genotoxicity of cobalt and had derived a threshold. A threshold was also set for cobalt in food contact materials/plastics (EFSA, 2012). The weight of evidence indicates some indication of genotoxicity but that thresholds had been derived in relation to intake and use in contact with foods. As a result it is proposed to determine as non-hazardous at this time based on the available data.
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			Does not meet the criteria for PBT. The EU harmonised classifications for sulfate and carbonate salts on basis of Co(II) indicate Muta 2. A range of evidence has been considered alongside the C&L classification. A number of reviews of the impact of cobalt have been undertaken by a range of organisations including Environment Canada and OECD. The data on the genotoxic effects of cobalt (II) are varying. A review by the EVM (2003) noted mixed results had been obtained for the genotoxicity of cobalt and had derived a threshold. A threshold was also set for cobalt in food contact materials/plastics (EFSA, 2012). The weight of evidence indicates some indication of genotoxicity but that thresholds had been derived in relation to intake and use in contact with foods. As a result it is proposed to determine as non-hazardous at this time based on the available data.

Does substance have breakdown products of concern? **No**

REFERENCES

Environment Canada (2011) http://www.ec.gc.ca/ese-ees/8E18277B-457E-4073-8F27-EF5878648820/batch10_4substances%281%29_en.pdf
ECHA C&L database https://echa.europa.eu/information-on-chemicals/cl-inventory-database?p_p_id=clinventory_WAR_clinventoryportlet&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-1&p_p
EQS for cobalt (DETR 1998) http://www.env.gov.bc.ca/wat/wq/BCguidelines/cobalt/cobalt_tech.pdf
EFSA (2012) http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2012.2905/abstract
EVM (2003) https://cot.food.gov.uk/sites/default/files/vitmin2003.pdf
CICADS (2006) Cobalt and inorganic cobalt compounds http://www.inchem.org/documents/cicads/cicads/cicad69.htm

Cyanide (Hydrogen cyanide) (CAS: 74-90-8)

The assessment relates to free cyanide which is principally HCN and the free cyanide ion (CN^-). HCN predominates at pH <9. This assessment would also be relevant to simple cyanides which readily dissociate to form free cyanide, eg sodium and potassium cyanide along with some metal cyanide complexes which readily dissociate, eg zinc and cadmium

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test				
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days				
Half life fresh or estuarine water ≥ 40 days	No	15days	EQS report (2012)	A half life of 15days has been reported for the cyanide ion. HCN has been reported to biodegrade but is noted to be toxic to unacclimated micro-organisms which would impact on the rate of biodegradation. HCN is noted to be volatile and volatilisation is a key removal process with half lives reported in the order of hours to days. As the assessment relates to groundwater the importance of volatilisation is more limited.
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days				
Half life in soil ≥ 120 days				
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**No**			
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	1.69 - 4.12	EQS report (2012)	Experimental BCF values for the rainbow trout. These low BCF values are supported by a calculated BCF of 0.73 reported in the assessment reports (ECHA 2014) produced under the Biocidal Products Directive.
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	0.35 - 1.07	EQS report (2012)	This is supported by a log Kow of 0.66 being reported in assessment reports (ECHA, 2014) under the Biocidal Products Directive
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?				
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.0052mg/l	EQS report (2012)	289d LOEC Bluegill sunfish. Other chronic fish studies showed similar chronic effect concentrations
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	Harmonised C&L classification for hydrogen cyanide indicates it does not meet the criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database	Harmonised C&L classification for hydrogen cyanide indicates it does not meet the criteria
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**	**Based on long term aquatic toxicity**		
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**	**Meets criteria for T but not P or B**		
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	No	15days	EQS report (2012)	A half life of 15days has been reported for the cyanide ion. HCN has been reported to biodegrade but is noted to be toxic to unacclimated micro-organisms which would impact on the rate of biodegradation. HCN is noted to be volatile and volatilisation is a key removal process with half lives reported in the order of hours to days. As the assessment relates to groundwater the importance of volatilisation is more limited.
Half life in marine, fresh or estuarine sediment ≥ 180 days				
Half life in soil ≥ 180 days				
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	1.69 - 4.12	EQS report (2012)	Experimental BCF values for the rainbow trout
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Does not meet either vP or vB criteria**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	Harmonised C&L classification for hydrogen cyanide indicates it does not meet the criteria for mutagenicity
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)				
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Does not meet criteria for P, B and T nor vPvB or Very Toxic**

Does substance have breakdown products of concern? **No**

REFERENCES

EQS report (2012) Proposed EQS for Water Framework Directive Annex VIII subs https://www.wfduk.org/sites/default/files/Media/Cyanide_Final_.pdf
ECHA (2014) https://echa.europa.eu/information-on-chemicals/biocidal-active-substances?p_p_id=echarevbiocides_WAR_echarevbiocidesportlet&p_p_lifecycle=1&p_p_state=normal&p_p_mode=view&p_p_col
ECHA C&L database https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/131393

Di(2-ethylhexyl)phthalate (CAS: 117-81-7)				
	Yes / No / Insufficent data / Borderline / assume yes or no?	**Value**	**Reference**	**Comments**
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	Yes		ECHA SVHC report	A number of reported studies indicating ready biodegradability
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days				
Half life fresh or estuarine water ≥ 40 days	Yes	50days	EU RAR (2008)	Degradation half life in surface water estimated from DT50 in eutrophic lake water.Degradation in surface waters observed to be temperature dependent. No biodegradation observed at 4oC. Biodegradation is the main route of removal.
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days	Yes	300days	EU RAR (2008)	Degradation rate expected to be much longer under anaerobic conditions.
Half life in soil ≥ 120 days	Yes	300days	EU RAR (2008)	Difficult to esimate DT50 but estimate of half life at 10oC is 300days and at room temperature 150days
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**No**			**The available data for DEHP is conflicting. Studies have shown that DEHP is readily biodegradable and the SVHC report notes that it is classified as readily biodegradable. Half life data shows that in some circumstances eg low temperatures and anaerobic then it can be persistent. Estimated half lives used by the EU meet the criteria for persistence however for EU assessments to date (eg the SVHC report) it is considered as readily biodegradable and not to meet the criteria for persistence. To be consistent with these assessments have therefore noted it does not meet the criteria for P but have included details of the half life data to indicate that under some circumstances has been found to have relatively long half lives.**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	840	SVHC report	The highest BCF for fish is noted to be 840. Measured BCFs for fish were reported in the range of 114 - 1380 in the EU RAR. A higher BCF is reported for invertebrates in the SVHC report with a BCF of 2700 being reported for Gammarus
Does field data show evidence for biomagnification?	No	0.07	EU RAR (2008)	Field evidence appears to show that DEHP does not biomagnify with the highest BMF value being 0.07
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Yes	7.5	EU RAR (2008)	This value was recommended in the EU RAR based on log Kow values in the range of 4.8 to 9.6
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not assessed due to above data			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			**The log Kow indicates it meets the criteria for bioaccumulation. However as BCF data is available this is used in preference. The assessment is based on the BCF data available for fish.**
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No		EU RAR (2008)	It is not considered appropriate to specify a chronic NOEC for DEHP following exposure via water due to difficulties in studying effects due to low solubility of DEHP. Indications are that DEHP does not show genuine toxic effects at concentrations up to and exceeding water solubility
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	Harmonised C&L classification indicates DEHP does not meet the criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Repr 1B	ECHA C&L database	Harmonised C&L classification is available and indicate it meets the criteria for reproductive effects. Its reported effects on reproduction are why DEHP has been identified as an SVHC under REACH
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			**Based on it being classified as Repr 1B**
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	No	50days	EU RAR (2008)	Surface water DT50 estimated from biodegradation in eutrophic lake water
Half life in marine, fresh or estuarine sediment ≥ 180 days	Yes	300days	EU RAR (2008)	Difficult to estimate DT50 but at temps 5-12oC biodegradation is not significant. Estimated half life of 300days. Degradation in anaerobic sediment noted to be slower than in aerobic
Half life in soil ≥ 180 days	Yes	300days	EU RAR (2008)	Difficult to estimate DT50 but rough estimate of half life at 10oC is 300days, and at room temperature 150days.
If answer to any question is YES, substance is very persistent	**No (see comment)**			**The available degradation data for sediment and soil indicate that it meets the criteria for persistence as under some conditions of low temperature and low oxygen levels then it will be more slowly degraded. Other studies report that it is readily degraded. EU assessments to date have noted that it is considered to be readily biodegradable and not considered persistent based on the criteria. To be consistent with other assessments have noted it as not meeting the criteria for persistence but included data to show that under some circumstances has been found to have relatively long half lives.**
Is bioconcentration factor ≥ 5000	No	840	SVHC report	The highest BCF for fish is noted to be 840. Measured BCFs for fish were reported in the range of 114 - 1380 in the EU RAR. A higher BCF is reported for invertebrates in the SVHC report with a BCF of 2700 being reported for Gammarus
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?				
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	Harmonised C&L classification indicates it does not meet these criteria
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)				
Is substance very toxic?	No			**Does not meet the criteria for mutagenicity.**
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Does not meet criteria for P, B and T. Some question over P but not considered to meet B. Not considered Very Toxic as not mutagenic and not considered to have no determinable threshold.**
Does substance have breakdown products of concern?	**No**			

REFERENCES

EU RAR (2008) EU Risk Assessment Report - Di(2-ethylhexyl)phthalate http://echa.europa.eu/documents/10162/e614617d-58e7-42d9-b7fb-d7bab8f26feb
ECHA C&L database https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/10536
ECHA SVHC report http://echa.europa.eu/documents/10162/e0a2db43-7a7f-4f18-92f9-2eaa3e4aff92
https://circabc.europa.eu/sd/a/337d62ba-6a8f-49ce-9c0e-591bb248e560/12 DEHP EQS Final%20Data%20Sheet.pdf

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
				Dibutyl phthalate (CAS: 84-74-2)
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	Yes		EU RAR(2004)	The report notes that a number of studies indicate ready biodegradability but that degradation rates may be slower in anaerobic environments
Passes inherent biodegradation test	No data			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	No	1-23 days	EU RAR(2004)	No degradation half life data given in ESR however as noted above noted to be readily biodegradable although degradation expected to be slower in anaerobic environments
Half life fresh or estuarine water ≥ 40 days	No data			
Half life marine sediment ≥ 180 days	No	2-180 days	EU RAR(2004)	No degradation half life data given in ESR however as noted above noted to be readily biodegradable although degradation expected to be slower in anaerobic environments
Half life fresh or estuarine sediment ≥ 120 days				
Half life in soil ≥ 120 days				
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**No**			
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	1.8	EU RAR(2004)	BCF of 2125 reported for Pimephales promelas, however this is based on 14-C and so will include all metabolites of the parent molecule and so over-estimates the substance's bioaccumulation potential. The selected value only accounts for the parent and not the monoester (known common metabolite), and so may under-estimate the BCF. However, the most relevant BCF, ie that which accounts for the parent and the monoester, will lie inbetween these two values and will be <2000 in fish.
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	See comment	4.57	EU RAR(2004)	Log Kow marginally above threshold however as BCF data is available latter is used in the assessment
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed due to above information			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			**BCF values do not exceed the threshold**
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	0.1 mg/L	EU RAR(2004)	NOEC (10d) *Gammarus pulex* and NOEC (60d) (post hatch) for *Onchorhynchus mykiss*
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	Harmonised C&L classification is available for dibutyl phthalate which indicates it does not meet the criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Repr 1B	ECHA C&L database	Harmonised C&L classification is available for dibutyl phthalate which indicates it meets the criteria for reproductive toxicity. It has been classified as an SVHC (Substance of Very High Concern) based on its reproductive effects.
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			Harmonised C&L classification indicates it meets the criteria for reproductive toxicity.
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet criteria for P or B**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	No	1-23 days	EU RAR(2004)	No degradation half life data given in ESR however as noted above noted to be readily biodegradable although degradation expected to be slower in anaerobic environments
Half life in marine, fresh or estuarine sediment ≥ 180 days	No Data			
Half life in soil ≥ 180 days	No	2-180 days	EU RAR(2004)	No degradation half life data given in ESR however as noted above noted to be readily biodegradable although degradation expected to be slower in anaerobic environments
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	1.8	EU RAR(2004)	BCF of 2125 reported for Pimephales promelas, however this is based on 14-C and so will include all metabolites of the parent molecule and so over-estimates the substance's bioaccumulation potential. The selected value only accounts for the parent and not the monoester (known common metabolite), and so may under-estimate the BCF. However, the most relevant BCF, ie that which accounts for the parent and the monoester, will lie inbetween these two values and will be <2000 in fish.
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Does not meet criteria for vP or vB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	Not assessed			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	Harmonised C&L classification for dibutyl phthalate indicates it does not meet the criteria for mutagenicity
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			**Does not meet the criteria for mutagenicity or no determinable threshold.**
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Does not meet the criteria for P, B and T nor those for either of the equivalent concern criteria,ie vPvB or vT (Muta)** **NB Dibutyl phthalate has been identified as a Substance of Very High Concern under REACH due to its reproductive effects**
Does substance have breakdown products of concern?	**No**			

REFERENCES

EU Risk Assessment Report dibutyl phthalate (with addendum 2004) http://echa.europa.eu/documents/10162/04f79b21-0b6d-4e67-91b9-0a70d4ea7500
ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/cl-inventory/view-notification-summary/16769

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
		Dichloromethane (CAS: 75-09-2)		
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	Yes	Readily biodegraded	HSDB	Noted to be readily biodegradable based on the results of an OECD 301 study.
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days				
Half life fresh or estuarine water ≥ 40 days				
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days	No	10.9days	OECD SIDS	Study noted a half life of 10.9days in natural sediment with an initial concentration of dichloromethane of 3.3mg/l
Half life in soil ≥ 120 days				
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)				
Is substance persistent?	**No**			Limited data was available on the persistence of dichloromethane. The data indicated hydrolysis was not a key process but that volatilisation was an important process along with biodegradation. Volatilisation however is not a key consideration for an assessment for groundwater. The available data do not indicate it meets the criteria for persistence.
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	2.3	Canadian EPA	Supported by data in the OECD SIDS assessment which noted BCFs in the range of 0.9 - 40
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	1.25	Canadian EPA; OECD SIDS	This is reported to be a measured log Kow value.
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed due to the above information			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	83 mg/l	OECD SIDS	28d NOEC for body weight endpoint in Pimephales promelas (fish); NOEC for mortality, larval survival endpoint = 142 mg/l. These were the lowest chronic toxicity endpoints located. Considering the acute toxicity data the invertebrate Daphnia magna was the most sensitive of the organisms tested. Chronic data was not available for this species. Due to the acute sensitivity the chronic toxicity was predicted using QSARs in the OECD SIDS assessment. The QSAR estimates gave a predicted 21d NOEC of 6.2mg/l and 13.3mg/l. This data supports the data indicating dichloromethane does not meet the criteria for aquatic toxicity.
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	EU harmonised classification did not assign STOT RE1 or RE2 although some of the notifications included on the database noted these.
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database	EU harmonised classification indicated Carc 2. No classification for mutagenicity although some industry notifications provided for the C&L process indicated Muta 2. Some studies have indicated that DCM may be mutagenic in some organisms as noted in USEPA (2011). The OECD SIDS document noted that overall the data indicate dichloromethane is not genotoxic in vitro. WHO (2003) also note that the data indicate it is not a genotoxic carcinogen.
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**No**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	No	7-56 days	EnviChem (accessed through eChemPortal)	Study on ECHA-CHEM in natural water/sediment system noted a half life of 10.9days. Study included on EnviroChem noted a groundwater estimated half life of 56days.
Half life in marine, fresh or estuarine sediment ≥ 180 days	No Data			
Half life in soil ≥ 180 days	No	9.4 - 191days	ECHA-CHEM	Studies on ECHA-CHEM in different soils indicated half lives in the range of 9.4 - 191days. The majority of the studies were below the criterion
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	2.3	Canadian EPA	Supported by data in the OECD SIDS assessment which noted BCFs in the range of 0.9 - 40
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			Does not meet criteria for vP and vB
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not Assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not Assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not Assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not Assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	Not Assessed			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database; WHO (2003)	EU harmonised classification indicates no classification for Muta. Some studies have indicated that DCM may be mutagenic in some organisms as noted in USEPA (2011). However in line with WHO guidelines on drinking water, are proposing that dichloromethane does not meet the criteria for mutagenic.
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Does not meet the criteria for P, B and T or those for equivalent concern, ie vPvB and Very Toxic**

Does substance have breakdown products of concern?

No- Eurochlor Environmental fate and impact of chlorinted solvents (2013) "Complex sequences of reactions then lead to the formation of products that include hydrogen chloride (HCl), phosgene (COCl2) and formyl chloride (HCOCl)"

REFERENCES

Canadian Environmental Protection Act- Priority Substances List Assessment Rep http://www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/contaminants/psl1-lsp1/dichloromethane/dichloromethane-eng.pdf
ECHA C&L database https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/7285
OECD SIDS assessment http://webnet.oecd.org/HPV/UI/handler.axd?id=b8ea971c-0c2c-4976-8706-a9a68033daa0
WHO (2003) http://www.who.int/water_sanitation_health/dwq/chemicals/dichloromethane.pdf

Dioxins				
	Yes / No / Insuffcent data / Borderline / assume yes or no?	**Value**	**Reference**	**Comments**
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test				
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days				
Half life fresh or estuarine water ≥ 40 days	Yes	1.5 years	US EPA fact sheet	
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days				
Half life in soil ≥ 120 days	Yes	>10years	POPS Toolkit	
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)				
Is substance persistent?	**Yes**			**Dioxins have been identified as a Persistent Organic Pollutant (POP) under the Stockholm Convention. POPs are of concern in the environment due to the fact they can accumulate in the tissues of organisms, are persistent and can be transported long distances and are toxic to organisms.**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	Approx 7900 to >173000	EU WFD EQS dossier	POP summary notes a BCF of 26707 in rainbow trout
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Yes	6 to 8.2	EU WFD EQS dossier	
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not considered due to above data			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**Yes**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.000000038mg/l	POP toolkit	56day NOEC *Onchorhynchus mykiss*
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	See comment		ECHA C&L database	Harmonised C&L classification not available. As other data, eg aquatic NOEC, and IARC classification supports high toxicity have not pursued this further
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes (see comment)	IARC Group 1 carcinogen	IARC	Harmonised C&L classification not available. 2,3,7,8-TCDD classified as a Group 1 carcinogen by IARC. Group1 indicates that is sufficient evidence to indicate carcinogenicity to humans
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**Yes**			**Meets the criteria for persistence, bioaccumulation and toxicity. Dioxins are classified as a POP (Persistent Organic Pollutant). Under the Stockholm Convention POPs are identfied based on the fact they are substances that are persistent in the environment and can be transported for long distances, are toxic and also can accumulate in the tissues of organisms.**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days				
Half life in marine, fresh or estuarine sediment ≥ 180 days	Yes	1.5 years	US EPA fact sheet	
Half life in soil ≥ 180 days	Yes	>10years	POPs Toolkit	
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	Yes	Approx 7900 to >173000	EU WFD EQS dossier	
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**Yes**			**Dioxins are classified as a POP (Persistent Organic Pollutant)**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?				
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No (see comment)			Harmonised C&L classification not available. IARC has been identified as a Group 1 carcinogen, which indicates sufficient information to indicate carcinogenicity to humans. Mutagenic effects have not been reported. WHO note that dioxins are not genotoxic carcinogens and therefore it is noted they have a threshold for carcinogenicity.
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			**Does not meet criteria for mutagencity or no determinable threshold.**
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**Meets the criteria for P, B and T as well as vP and vB. Dioxins are classified as a POP (Persistent Organic Pollutant)**
Does substance have breakdown products of concern?	**No**			

REFERENCES

EU WFD EQS dossier (2012) https://circabc.europa.eu/sd/a/f0d90906-c361-4af1-82b1-d2e52f826c14/Dioxins%20&%20PCB-DL%20EQS%20dossier%202011.pdf
US EPA Factsheet http://www.epa.gov/ogwdw/pdfs/factsheets/soc/tech/dioxin.pdf
POPs Toolkit http://www.popstoolkit.com/about/chemical/dioxin.aspx
IARC (2012) http://monographs.iarc.fr/ENG/Monographs/vol100F/mono100F-27.pdf

Ethylene glycol (CAS Number: 107-21-1)				
	Yes / No / Insufficent data / Borderline / assume yes or no?	**Value**	**Reference**	**Comments**
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	Yes		CICAD 22	SIDS report notes an OECD 301 study showing 96% degradation in 28days
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	No	<20days	CICAD 22	
Half life fresh or estuarine water ≥ 40 days	No	<21days	CICAD 22	
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days				
Half life in soil ≥ 120 days	No	2-12days	Environment Canada (2000)	
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**No**			The available data indicates it does not meet the criteria for persistence
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	0.6 to 190	CICAD 22	190 refers to algae, BCF of 10 measured in the golden orfe
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	-1.36	CICAD 22	
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not assessed due to the above information			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative *If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained*				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			The available data indicates it does not meet the criteria for bioaccumulation.
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	8590mg/l	US EPA Ecotox database; CICAD 22	NOEC (7d) *Ceriodaphnia*
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	EU harmonised C&L classification for ethylene glycol indicates it does not meet the criteria as not classified as STOT RE1 or RE2
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database	EU harmonised C&L classification for ethylene glycol indicates it does not meet the criteria for carcinogenicity, mutagenicity or toxic for reproduction
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**No**			The available data indicates it does not meet the criteria for toxicity
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Doesn't meet criteria for P, B or T**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	No	<21days	CICAD 22	
Half life in marine, fresh or estuarine sediment ≥ 180 days				
Half life in soil ≥ 180 days	No	2-12days	Environment Canada (2000)	
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	0.6 to 190	CICAD 22	190 refers to algae, BCF of 10 measured in the golden orfe
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Doesn't meet criteria for vP or vB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	Not assessed			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	EU harmonised C&L classification available and no classification for mutagenicity assigned
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Does not meet criteria for P, B and T nor those for vPvB or Very Toxic**
Does substance have breakdown products of concern?	**No**			

REFERENCES

ECHA C&L database	https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/53082
US EPA Ecotox Database	http://cfpub.epa.gov/ecotox/quick_query.htm
Concise International Chemical Assessment Document 22 (environment)	http://www.who.int/ipcs/publications/cicad/en/cicad22.pdf
Concise International Chemical Assessment Document 45 (Human health)	http://www.who.int/ipcs/publications/cicad/en/cicad45.pdf
Environment Canada (2000) Priority Substance List State of the Environment Report for Ethylene Glycol	http://www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/contaminants/psl2-lsp2/ethylene_glycol/ethylene_glycol-eng.pdf

Flufenacet (CAS: 142459-58-3)				
	Yes / No / Insufficent data / Borderline / assume yes or no?	**Value**	**Reference**	**Comments**
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	No		EU PPPD review	Notes flufenacet is not readily biodegradable
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days				
Half life fresh or estuarine water ≥ 40 days	Yes	46.3 - 61.7days	EU PPPD review	
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days	No	76.4 - 84.6days	EU PPPD review	Study involving the whole system, ie water and sediment
Half life in soil ≥ 120 days	No	15-86days	EU PPPD review	Results from studies using various soil types. A half life of 86days was noted for cooler temperatures
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	71.4	EU PPPD review	BCF value for fish noted in the EU review
Does field data show evidence for biomagnification?	No data			
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	3.2	EU PPPD review	
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed due to above data being available			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			**Neither the BCF or log Kow data indicate it meets the criteria for B**
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.002	EU PPPD review	Lowest acute toxicity value was a the value of 0.002mg/l reported for the 72hr EC50 for the alga Selenastrum capricornutum. Algal species are much more sensitive than either invertebrates or fish. No chronic data located however based on the acute data potential to meet the criteria. The chronic fish study NOEC (97days) for Onchorynchus mykiss was 0.2mg/l
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	Yes	STOT RE2	ECHA C&L database	Harmonised C&L classification available for flufenacet. It is classified as STOT RE2 and therefore meets this criterion.
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database	Harmonised C&L classification available for flufenacet. The classification indicates it does not meet the criteria for C, M or R
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			**Meets criteria for chronic NOEC as well as STOT RE2**
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet criteria for B**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Borderline yes	46.3 - 61.7days	EU PPPD review	The upper value given for the water degradation half life indicates exceedance of the criteria
Half life in marine, fresh or estuarine sediment ≥ 180 days	No	76.4 - 84.6days	EU PPPD review	
Half life in soil ≥ 180 days	No	15-86days	EU PPPD review	
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	71.4	EU PPPD review	BCF value reported for fish
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Does not meet vB criteria although persistence in water criteria is met based on some of the degradation results**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?				
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	Harmonised C&L classification available for flufenacet. It is not classified as mutagenic.
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			

Does substance have breakdown products of concern? **No**

REFERENCES

EU PPPD review (2003) http://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/public/?event=activesubstance.detail&language=EN&selectedID=1380

ECHA C&L database https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/107101

Gluteraldehyde (CAS: 111-30-8)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	Yes		OECD SIDS	OECD 301D study (74% in 28 days). Gluteraldehyde is also noted to be readily biodegradable in an EU review undertaken for the EU biocide requlations (EU, 2014).
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	No data			
Half life fresh or estuarine water ≥ 40 days	No	10hours	OECD SIDS	Limited data is available on the degradation of gluteraldehyde. The available data indicates it does not meet the persistence criteria as supported by the ready biodegradability study noted above.
Half life marine sediment ≥ 180 days	No data			
Half life fresh or estuarine sediment ≥ 120 days	No data			
Half life in soil ≥ 120 days	No data			
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**No**			**Gluteraldehyde has been observed to be readily biodegradable. This is supported by limited data on the degradation half lives for gluteraldehyde. Although the data is limited the available information indicates it does not meet the persistence criteria.**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No		OECD SIDS	No BCF data was located. The SIDS review notes that as gluteraldehyde is hydrophilic and non-persistent it is not expected to bioaccumulate. This is supported by the log Kow data
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	-0.01, -0.18	OECD SIDS, EPA (2007)	These low values are also supported by data in the EU reviews undertaken for the purposes of the biocidal regulations. Log Kow of -0.33 and -0.36 were reported in the review for some biocidal uses (EU, 2014)
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not assessed due to the availability of the above information			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers)				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers)				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			**Limited data is available but the weight of evidence indicates it does not meet the criteria for bioaccumulation**
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	0.625 mg/L	OECD SIDS	0.625 mg/L algae (biomass endpoint), 2.1mg/l 21d Daphnia magna study
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	EU harmonised C&L classification available for gluteraldehyde. The classification shows it does not meet the criteria.
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database; OECD SIDS	EU harmonised C&L classification available for gluteraldehyde. The classification shows it does not meet the criteria.
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**No**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Gluteraldehyde does not meet the criteria for persistence, bioaccumulation or toxicity**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	No	10hours	OECD SIDS	Limited data is available on the degradation of gluteraldehyde. The available data indicates it does not meet the persistence criteria as supported by the ready biodegradability study noted above.
Half life in marine, fresh or estuarine sediment ≥ 180 days	No data			
Half life in soil ≥ 180 days	No data			
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No		OECD SIDS	No BCF data was located. The SIDS review notes that as gluteraldehyde is hydrophilic and non-persistent it is not expected to bioaccumulate. This is supported by the log Kow data
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Gluteraldehyde does not meet the criteria for either vP or vB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic,				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L Database; OECD SIDS	EU harmonised C&L classification available for gluteraldehyde. The classification shows it does not meet the criteria.
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Does not meet the criteria for P, B or T nor vPvB or Very Toxic**
Does substance have breakdown products of concern?	**No**			

REFERENCES

EPA (2007) Reregistration Eligibility Decision for Glutaraldehyde EPA 739-R-07- http://www3.epa.gov/pesticides/chem_search/reg_actions/reregistration/red_PC-043901_28-Sep-07.pdf
OECD SIDS for Gluteraldehyde http://webnet.oecd.org/Hpv/UI/handler.axd?id=da11e1ee-332f-4be5-96ef-d1d4f81d3d57
ECHA C& L Database https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discl/details/115859
EU (2014) http://dissemination.echa.europa.eu/Biocides/ActiveSubstances/1310-02/1310-02_Assessment_Report.pdf

Hexabromocyclododecane (HBCDD) (CAS: 25637-99-4)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	No	None in 28 days	EU RAR	No biodegradation of HBCDD at 7.7 mg/l was observed over the 28-day test period.
Passes inherent biodegradation test	No data			
If answer to either question is YES, substance is not persistent *If answer to both questions is NO, additional data on half life is required*				
Half life marine water ≥ 60 days Half life fresh or estuarine water ≥ 40 days Half life marine sediment ≥ 180 days	No data No data No data			
Half life fresh or estuarine sediment ≥ 120 days	Yes	210 days	ECHA SVHC	OECD 308 study. This is a half life in sediment recalculated at 12oC and based on the alpha isomer. A further studv on the oamma isomer indicated a half life of 197davs at 12oC.
Half life in soil ≥ 120 days	Yes	No degradation	ECHA SVHC	No degradation refers to one study in aerobic soil. Another study study value of 119 days is reported.
If answer to any question is YES, substance is persistent *If answer to all questions is NO, substance is not persistent*				
Is sufficient data available? (if not assume substance is	Yes			
Is substance persistent?	**Yes**			**Based on soil data with sediment data supporting conclusion (although some isomers may not fulfill P criterion). HBCDD has been identified as a POP, ie Persistent Organic Pollutant under the Stockholm Convention and has been reported to be detected in remote areas providing evidence of persistence in the environment**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	18100	EU RAR; ECHA SVHC	32-day study , steady state result, for the fish *Pimephales promelas*
Does field data show evidence for biomagnification?	Yes		EU RAR; ECHA SVHC	Lab study for dietary uptake in trout clearly demonstrating biomagnification (dietary BMFs for the ß- and γ-diastereomers calculated as 9.2, 4.3 and 7.2, respectively). The SVHC report notes a large set of measured data in biota in the field show, that HBCDD is biomagnified in the environment. Increasing concentrations of HBCDD have been found in several time series of, e.g. birds and marine mammals.
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Yes	5.63	EU RAR	Value measured for the technical product (mixture of isomers)
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not assessed due to the availablity of the above info			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative *If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained*				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**Yes**			Based on BCF and log Kow data
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.0031mg/l	EU RAR	NOEC (21d) *Daphnia magna*
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA-C&L database	EU harmonised C&L classification. It is not classified as either STOT RE1 or RE2 and therefore doesn't meet the criteria.
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Repr 2	ECHA-C&L database	EU harmonised C&L classification. It is classsified as Repr 2 and therefore meets the criteria
If answer to any question is YES, substance is toxic *If answer to all questions is NO, substance is not toxic*				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**Yes**			**Agreed PBT in the EU under REACH as outlined in the SVHC report. Also identified as a POP (Persistent Organic Pollutant)**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	No data			
Half life in marine, fresh or estuarine sediment ≥ 180 days	Yes	210 days	ECHA SVHC	OECD 308 study
Half life in soil ≥ 180 days	Yes	No degradation; 119 days	ECHA SVHC	No degradation refers to one study in aerobic soil; second study value represents dissipation Time 50, therefore underestimates degradation.
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	Yes	18100	EU RAR; ECHA SVHC	32-day study , steady state result, for the fish *Pimephales promelas*
If answer is ves. substance is verv bioaccumulative				
Is substance very persistent and very bioaccumulative?	**Yes**			**The SVHC agreement report notes that it is vB but does not indicate vP even though a study reported for sediment indicates a half life of >180days.**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	Not assessed			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	EU harmonised C&L classification. It is not classified as Muta 1A, 1B or 2. The EU risk assessment report for this substance has summarised the available data and states that 'the preponderance of evidence from available studies indicates that HBCDD lacks significant genotoxic potential in vitro as well as in vivo'. This supports the proposal that HBCDD does not meet the criteria for Very Toxic
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**Has been identified as a PBT substanceunder REACH (ECHA SVHC report). HBCD has also been designated as a POP under the Stockholm Convention.**
Does substance have breakdown products of concern?	**No**			

REFERENCES

EU RISK ASSESSMENT- Hexabromocyclododecane (2008) http://echa.europa.eu/documents/10162/661bff17-dc0a-4475-9758-40bdd6198f82
ECHA SVHC support document (2008) https://echa.europa.eu/documents/10162/3f5de199-8732-4881-aec6-730bf9499a36
ECHA-C&L database https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discl/details/104361
ECHA SVHC Agreement (2008) https://echa.europa.eu/documents/10162/47d061d9-e336-4139-883b-f00331278cda

Hexachlorobenzene (CAS: 118-74-1)				
	Yes / No / Insufficent data / Borderline / assume yes or no?	**Value**	**Reference**	**Comments**
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test				
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days				
Half life fresh or estuarine water ≥ 40 days	Yes	2.7 to 5.7 years	EFSA (2006)/ Eurochlor (2005)	Eurochlor (2005) reported half lives in groundwater of 5.3 - 11.4years have been estimated
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days				
Half life in soil ≥ 120 days	Yes	3 to 6 years	EFSA (2006)	
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			**The available data indicates that hexachlorobenzene meets the criteria for P. It has been identified as a POP, ie Persistent Organic Pollutant under the Stockholm Convention**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	22000	EFSA (2006)	This BCF value relates to fish. A number of BCFs for fish have been reported with a large proportion being above the threshold of 2000
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Yes	5.2 to 6.5	EFSA (2006)	
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed due to the above information			
Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative *If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained*				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**Yes**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.0049mg/l	POPs Toolkit	32d NOEC for fathead minnow
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	Yes	STOT RE1	ECHA C&L database	Harmonised C&L classification
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Carc 1B	ECHA C&L database	Harmonised C&L classification
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**Yes**			**Meets the criteria for P, B and T**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes	2.7 to 5.7years	EFSA (2006)	Hexachlorobenzene has been identified as a POP, ie Persistent Organic Pollutant
Half life in marine, fresh or estuarine sediment ≥ 180 days				
Half life in soil ≥ 180 days	Yes	3 to 6 years	EFSA (2006)	
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	Yes	22000	EFSA (2006) and POPs Toolkit	This BCF value relates to fish. A number of BCFs for fish have been reported with a large proportion being above the threshold of 2000
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**Yes**			**Meets criteria for both vP and vB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	Harmonised C&L classification. It is not classified as mutageni
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)				
Is substance very toxic?	**No**			**Does not meet the criterion for Very Toxic as not classified as mutagenic.**
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**It meets the criteria for PBT and vPvB. It has not however been formally noted as a PBT substance within the EU under REACH. Hexachlorobenzene has been identified as a POP (Persistent Organic Pollutant)**
Does substance have breakdown products of concern?	**No**			

REFERENCES

EFSA (2006) Opinion of the Scientific Panel on Contaminants in the food chain on a request from the Commission related to hexachlorobenzene as undesirable substances in animal feed — http://www.efsa.europa.eu/sites/default/files/scientific_output/files/main_documents/CONTAM_op_ej402_hexachlorobenzene_en%2C3.pdf

ECHA C&L database — https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/65830

POPs Toolkit — http://www.popstoolkit.com/about/chemical/hcb.aspx

Environment Canada (1993) — http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/psl1-lsp1/hexachlorobenzene/index-eng.php

Eurochlor (2005) — http://www.eurochlor.org/media/14951/sd9-hexachlorobenzene-final.pdf

Hexachlorobutadiene (HCBD) (CAS: 87-68-3)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	No		UNEP	Results from a test on ready biodegradability undertaken according to OECD TG 301 C(adapted for volatile substances) indicated not readily biodegradable
Passes inherent biodegradation test	No data			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	No data			
Half life fresh or estuarine water ≥ 40 days	Yes	28-360	UNEP	The half lives at the upper end of the reported range exceed the criteria
Half life marine sediment ≥ 180 days	No data			
Half life fresh or estuarine sediment ≥ 120 days	No data			
Half life in soil ≥ 120 days	Yes	28-180	UNEP	The half lives at the upper end of the reported range exceed the criteria
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			**Upper bound values used as worst case. Hexachlorobutadiene is an agreed POP, ie Persistent Organic Pollutant**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	29-18000	UNEP	The BCF values at the upper end of the reported range exceed the criteria
Does field data show evidence for biomagnification?	No Data			
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Yes	4.78-4.9	UNEP	
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed due to the above data			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative *If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers). BCF data should be obtained*				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**Yes**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.0065 mg/l	UNEP	NOEC *Pimephales promelas*
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA- C&L database	No formal EU harmonised C&L classification. Industry have submitted proposals
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes		ECHA- C&L database, COT (2000)	No formal EU harmonised C&L classification. Industry have submitted proposals. Both the UK Committee on Toxicity and that on Mutagenicity of chemicals in Food Consumer Products and the Environment (COT and COM) have considered this substance to be mutagenic with no assumed threshold for adverse effects
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**Yes**			**Meets the criteria for persistence, bioaccumulation and toxicity. Hexachlorobutadiene is designated as a Persistent Organic Pollutant**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes	28-360	UNEP	The half lives at the upper end of the reported range exceed the criteria
Half life in marine, fresh or estuarine sediment ≥ 180 days	No Data			
Half life in soil ≥ 180 days	Yes	28-180	UNEP	The half lives at the upper end of the reported range exceed the criteria
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	Yes	29-18000	UNEP	The BCF values at the upper end of the reported range exceed the criteria
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**Yes**			**Upper values used as worst case. Hexachlorobutadiene is an agreed POP, ie Persistent Organic Pollutant**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not Assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not Assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not Assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not Assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	Not Assessed			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	Yes		COT (2000)	No EU harmonised C&L classification. Both the UK Committee on Toxicity and that on Mutagenicity of chemicals in Food Consumer Products and the Environment (COT and COM) have considered this substance to be mutagenic with no assumed threshold for adverse effects
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**Yes**			**Although no formal C&L harmonised classification is available a review of evidence by two UK Committees has indicated HCBD is mutagenic with no assumed threshold**
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**Meets criteria for PBT and vPvB. Has been designated as a POP (Persistent Organic Pollutant). Also meets criteria for Very Toxic**
Does substance have breakdown products of concern?	**No**			

REFERENCES

ECHA - C&L database https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/80395

UNEP Stockholm Convention on POPS (2013) Draft risk management evaluation: hexachlorobutadiene http://chm.pops.int/TheConvention/POPsReviewCommittee/Meetings/POPRC9/Documents/tabid/3281/ctl/Download/mid/10330/Default.aspx?id=149&ObjID=16844

COT (2000) http://cot.food.gov.uk/committee/committee-on-toxicity/cotstatements/cotstatementsyrs/cotstatements2000/hexachlorobutadiene

	Hexachlorocyclohexane (assessment based on gamma- hexachlorocyclohexane (CAS: 58-89-9) (also known as lindane) however also relevant to other isomers eg beta and alpha which are also designated as POPs)			
	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test				
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days				
Half life fresh or estuarine water ≥ 40 days	Yes	3 - 300days	UNEP (2006)	The half lives in the upper range of the reported range exceed the criteria. Gamma HCH (also known as lindane has been identified as a POP (Persistent Organic Pollutant) along with the alpha and beta isomers of hexachlorocyclohexane
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days				
Half life in soil ≥ 120 days	Yes	88 - 1146days	UNEP (2006)	See above
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	10 to 4220	UNEP (2006)	The BCFs at the upper end of the reported range exceed the criteria
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	3.72	HSDB	
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed due to above information			
Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**Yes**			**Based on the BCF data. This is also supported by field data which indicates the presence of lindane in a range of sea birds and mammals in relatively remote areas eg Arctic**
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.0029mg/l	UNEP (2006)	Fish NOAEC
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	Yes	STOT RE2	ECHA C&L database	Harmonised C&L classification. The classification indicates it meets the criteria for STOT RE2
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database	Harmonised C&L classification. The classificaiton indicates it does not meet the criteria
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			**Yes based on aquatic toxicity and STOT RE2.**
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**Yes**			**Meets the criteria for P, B and T. Has been designated as a POP**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes	3 - 300days	UNEP (2006)	The half lives in the upper range of the reported range exceed the criteria. Gamma HCH (also known as lindane has been identified as a POP (Persistent Organic Pollutant) along with the alpha and beta isomers of hexachlorocyclohexane
Half life in marine, fresh or estuarine sediment ≥ 180 days				
Half life in soil ≥ 180 days	Yes	88 - 1146days	UNEP (2006)	See above
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	10 to 4220	UNEP (2006)	
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**The BCF values did not meet the criteria**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	Harmonised C&L classification. The classification indicates it does not meet the criteria for mutagenicity.
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**It meets the crtiera for P, B and T although not formally classified as PBT in the EU. Isomers of hexachlorocyclohexane have been designated as POPs.**
Does substance have breakdown products of concern?	**No**			

REFERENCES

HSDB (Hazardous Substance Database) http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB
ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database
UNEP (2006) Persistent Organic Pollutants Review Committee - Lindane Risk Profile http://chm.pops.int/Portals/0/Repository/poprc2/UNEP-POPS-POPRC.2-17-Add.4.English.PDF

Indeno (1,2,3-cd) pyrene (CAS: 193-39-5)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	Insufficient data			
Passes inherent biodegradation test	Insufficient data			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Insufficient data		ECHA 2009	PAHs can undergo photolysis but not a significant pathway as only operates in top few cm of water column; PAHs with 4 or more rings, which includes indeno(123cd)pyrene, undergo little biodegradation in water
Half life fresh or estuarine water ≥ 40 days	Insufficient data		ECHA 2009	PAHs can undergo photolysis but not a significant pathway as only operates in top few cm of water column; PAHs with 4 or more rings, which includes indeno(123cd)pyrene, undergo little biodegradation in water
Half life marine sediment ≥ 180 days	Insufficient data		ECHA 2009	PAHs with 4 or more rings, eg indeno(123cd)pyrene undergo very slow biodegradation in aquatic sediments
Half life fresh or estuarine sediment ≥ 120 days	Insufficient data		ECHA 2009	ECHA 2009 noted no experimental data available but that estimated data indicated half lives of >400days.
Half life in soil ≥ 120 days	Yes	139-289 days	Toxnet	ECHA 2009 noted no experimental data available but that estimated data indicated half lives of >400days.
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			**The available experimental data for degradation of indeno (123cd)pyrene was limited however based on the available data and that for other PAHs it was considered to meet the criteria for persistence.**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	>2000	ECHA 2009; Bleeker and Verbruggen	Limited data with no experimentally derived BCFs noted in the ECHA 2009 document. The latter noted that on the basis of similarities in their Kow values and molecular sizes with other PAHs for which BCFs above the bioaccumulation criteria have been experimentally confirmed, it is anticipated that BCF values for this substance will be >2000. PAHs are generally rapidly metabolised in fish but accumulate in crustacea and molluscs.
Does field data show evidence for biomagnification?	No data			PAHs are known to biomagnify in lower trophic levels, but biodilute in fish and some invertebrates able to metabolise the substance.
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Yes	6.58	ECHA 2009	Calculated; ClogP method
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not assessed due to the above information being available			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**Yes**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.00027	CIS 2005; ECHA 2009	7d EC10 in *Ceriodaphnia* with standard lighting conditions
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	Insufficient data		ECHA C&L database	No EU C&L harmonised classification. ECHA C&L database contains very little data for indeno(123cd)pyrene and no notifications from industry are listed other than for carcinogenicity. The notifications submitted do not give information re: STOT RE
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Insufficient Data		ECHA C&L database; IARC	No EU harmonised C&L classification. ECHA C&L database contains very little data for indeno(123cd)pyrene and no notifications listed other than for carcinogenicity. The notifications submitted indicate Carc 2. This substance has been considered by IARC on a number of occasions (1973, 1983 and 2010).These analyses indicate that there is data available to assess the carcinogenicity of this substance. IARC concluded that it was possibly carcinogenic to humans (Group 2B) and that there was sufficient evidence in experimental animals for the carcinogenicity of this substance.
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			**Based on aquatic toxicity data. Also IARC data indicate potentially carcinogenic**
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**Yes**			**Meets criteria for persistence, bioaccumulation and toxicity**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Insufficient data		ECHA 2009	PAHs can undergo photolysis but not a significant pathway as only operates in top few cm of water column; PAHs with 4 or more rings, which includes indeno(123cd)pyrene, undergo little biodegradation in water
Half life in marine, fresh or estuarine sediment ≥ 180 days	Insufficient data		ECHA 2009	PAHs with 4 or more rings, eg indeno(123cd)pyrene undergo very slow biodegradation in aquatic sediments
Half life in soil ≥ 180 days	Yes	139-289 days	Toxnet	ECHA 2009 noted no experimental data available but that estimated data indicated half lives of >400days.
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	>2000 <5000	ECHA 2009	Read across from related PAHs indicates it would have a BCF >2000 (but not >5000). Limited data with no experimentally derived BCFs noted in the ECHA 2009 document. The latter noted that on the basis of similarities of their Kow values and molecular sizes with other PAHs for which BCFs above the bioaccumulation criteria have been experimentally confirmed, it is anticipated that BCF values for this substance will be >2000.
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Meets criteria for vP but not vB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	Insufficent Data		ECHA C&L Database	Only notified EU C&L classifications available for carcinogenicity. No notifications re: mutagenicity
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	No			
Is substance very toxic?	**See comment**			Insufficient data available. Indeno(123cd)pyrene already classified as Hazardous based on consideration of data for P, B and T
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**Available data limited but indicates meets criteria for persistence, bioaccumulation and toxicity based on consideration of data for other similar PAHs.**
Does substance have breakdown products of concern?	**No**			

REFERENCES

ECHA 2009 (SVHC dossier for coal tar pitch) http://echa.europa.eu/documents/10162/8b23f02f-452d-459b-a043-76cba8104dbe

CIS. 2005. Substance datasheet - PAHs https://circabc.europa.eu/sd/a/996c9804-30c4-4ea1-b16d-3cbc571b2bac/28_PAH_EQSdatasheet_310705.pdf

Lead

This assessment relates to inorganic forms of lead. In the freshwater environmental Pb(II) is found to predominate. Although many lead compounds are relatively insoluble eg lead carbonate some forms are soluble, eg lead chloride and lead nitrate. In addition the amount of free lead ion present is dependent on factors such as the pH of the water.

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes readv biodegradation test	Test not applicable for metals/inorganics			
Passes inherent biodegradation test	See above			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Degradation testing not applicable for metals/inorganics			
Half life fresh or estuarine water ≥ 40 days	See above			
Half life marine sediment ≥ 180 days	See above			
Half life fresh or estuarine sediment ≥ 120 days	See above			
Half life in soil ≥ 120 days	See above			
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)				
Is substance persistent?	**Yes**			**The persistence criteria are not directly applicable to metals/inorganics and were developed principally for organic substances. Metals and inorganics such as lead are inherently persistent and subject to transformation rather than degradation. Lead will therefore not degrade but will be transformed depending on a range of factors including the local conditions, eg pH, and other salts present.**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	5 to 8000	ESR (2008)/ WHO/EFSA	BCF values for a range of organisms including crustaceans, molluscs, insects and fish were reported in the voluntray risk assessment. These indicated BCF values in the range of 5 - 8000. In addition information on human health indicates that lead accumulates in the bones following long term exposure with half lives reported in the order of 10 - 30years. Available bioconcentration factor (BCF) values are wide ranging, however based on the number of BCF values reported above 2000, along with evidence of accumulation in humans, the weight of evidence suggests lead met the criteria.
Does field data show evidence for biomagnification?	No		ESR (2008)/EU EQS (2011)	The avaiable data report that although plants and animals may bioconcentrate lead it does not appear to biomagnify in the aquatic food chain. It is noted this may be partly explained by the fact that in vertebrates lead is stored mainly in bone which reduces the risk of lead tansferring to other organisms in the food chain.
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Log K_{ow} values are not applicable to metals			Log K_{ow} values are not considered reliable estimates of the bioaccumulation potential of inorganic substances such as lead.
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100a/mol Octanol solubility ≤ 0.002mmol/l	Not considered due to the above data			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**Yes**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.0017mg/l	EU EQS dossier	Lymnaea stagnalis EC10 1.7ug/l Chronic effect concentrations of <10ug/l were reported for other species including Hyallela azteca and Pseudokirchneriella subcapitata
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	Yes	STOT RE2	ECHA C&L database	A number of lead compounds have been classified under CLP and have been determined as STOT RE2.
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Repr 1A	ECHA C&L database	A number of lead compounds have been classified under CLP and have been determined as Repr 1A. A nubmer of lead compounds have been identified as Substances of Very High Concern under REACH as a result of meeting the criteria for 'Toxic for Reproduction'
If answer to any question is YES. substance is toxic				
If answer to all questions is NO. substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			**Meets criteria for chronic aquatic toxicity and human toxicity through STOT RE2 and Repr 1A**
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**Yes**			
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	See comment			The persistence criteria are not directly applicable to metals/inorganics and were developed principally for organic substances. Metals and inorganics such as lead are inherently persistent and subject to transformation rather than degradation. Lead will therefore not degrade but will be transformed depending on the local conditions, eg pH and other salts present.
Half life in marine, fresh or estuarine sediment ≥ 180 days	See comment			
Half life in soil ≥ 180 days	See comment			
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	Yes	5 to 8000	ESR (2008)/ WHO/EFSA	BCF values for a range of organisms including crustaceans, molluscs, insects and fish were reported in the voluntray risk assessment. These indicated BCF values in the range of 5 - 8000. In addition information on human health indicates that lead accumulates in the bones following long term exposure with half lives reported in the order of 10 - 30years. Available bioconcentration factor (BCF) values are wide ranging, however based on the number of BCF values reported above 2000, along with evidence of accumulation in humans, the weight of evidence suggests lead met the criteria.
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**Yes**			
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	Yes	No determinable threshold'	ECHA C&L database/WHO/EFSA	A number of lead compounds have been classified under C&L however none were classified as mutagenic. Reviews undertaken by both WHO and EFSA report that there is no evidence of a threshold for critical lead induced effects and therefore lead meets the criteria for 'no determinable threshold'.
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**Yes**			**WHO and EFSA have noted that no evidence of a threshold for critical lead induced effects. A drinking water threshold for lead remains however this reflects technical achievability based on lead pipes etc rather than the intrinsic properties of lead.**
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**WHO and EFSA have noted thatno evidence of a threshold for critical lead induced effects**

Does substance have breakdown products of concern? **No**

REFERENCES

ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database
ECHA (2008) http://echa.europa.eu/web/guest/voluntary-risk-assessment-reports-lead-and-lead-compounds
WHO (2015) http://www.who.int/mediacentre/factsheets/fs379/en/
WHO (2011) http://www.who.int/water_sanitation_health/dwq/chemicals/lead.pdf
EFSA (2013) http://www.efsa.europa.eu/sites/default/files/scientific_output/files/main_documents/1570.pdf
EU EQS Dossier (2012) https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwiPr8K27LDLAhWE6xQKHZPVD2QQFggcMAA&url=https%3A%2F%2Fcircabc.europa.eu%2Fsd

Mecoprop (racemate)(CAS: 7085-19-0); mecoprop-p (CAS: 16484-77-8)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test				
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days				
Half life fresh or estuarine water ≥ 40 days	Yes	24 - 49days	EU PPPD review (2003)	
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days	No	23-67days	EU PPPD review (2003)	
Half life in soil ≥ 120 days	No	6.3 - 12days	EU PPPD review (2003)	
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			**Upper degradation half life in water is above the criterion**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	3-141	EU PPPD review/EA (2007)	The BCF values noted in the EU PPPD assessment were in the range of 3 - 5.5 for fish which also indicates that mecoprop does not meet the criteria for biaoccumulation
Does field data show evidence for biomagnification?	No data			
If answer to either question is YES. substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	0.6	EU PPPD review (2003)	The value is the log Kow for pH 7. Log Kow varies with pH log Kow 0.23 for pH 10
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not assessed due to the above data			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative *If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained*				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			**The available BCF and log Kow data indicate it does not meet the criteria for bioaccumulation**
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	0.055	EA 2007	Lowest value is a NOEC for *Navicula pelliculosa* . The values in the EU PPPD are much higher, ie the lowest chronic NOEC was for an invertebrate and was 22mg/l. This provides additional support that the chronic criterion was not exceeded
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	Harmonised C&L classification. Classification indicates that the criteria are not met
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database	Harmonised C&L classification. Classification indicates that the criteria are not met
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**No**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet criteria for B or T**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	No	24- 49days	EU PPPD review (2003)	
Half life in marine, fresh or estuarine sediment ≥ 180 days	No	23-67days	EU PPPD review (2003)	
Half life in soil ≥ 180 days	No	6.3 - 12days	EU PPPD review (2003)	
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	3-141	EU PPPD review/EA (2007)	The BCF values noted in the EU PPPD assessment were in the range of 3 - 5.5 for fish which also indicates that mecoprop does not meet the criteria for biaoccumulation
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?				
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	Harmonised C&L classification. Classification indicates that the criteria are not met
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	No			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Does not meet the criteria for P, B and T nor those for Equivalent Concern, ie vPvB or mutagenic/no determinable threshold**
Does substance have breakdown products of concern?	**No**			

REFERENCES

EA 2007 - Environmental Quality Standard for the protection of aquatic life - mecoprop https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/291213/scho1110bteo-e-e.pdf

EU PPPD (2003) - risk assessment reports for mecoprop (CAS: 7085-19-0) and (16484-77-8) http://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/public/?event=activesubstance.detail&language=EN&selectedID=1538

ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database

Mercury as mercury (II)

Mercury (II) is the most commonly found form of inorganic mercury in the freshwater environment, eg mercury (II) chloride, mercury (II) oxide, mercury (II) nitrate. The assessment would also extend to methyl mercury as an environmentally relevant form. Inorganic mercury is commonly converted in the environment to organic forms of mercury such as methyl mercury through the action of microbes. Methyl mercury is more toxic and bioaccumulates to a greater extent than inorganic mercury.

	Yes / No / Insuffient data / Borderline / assume yes or no?	Value		Comments
Is substance persistent. bioaccumulative and toxic?				
Persistence				
Passes ready biodegredation test	Test not applicable for			
Passes inherent biodegredation test	Test not applicable for			
If answer to either question is YES. substance is not persistent				
If answer to both questions is NO. additional data on half life is required				
Half life marine water ≥ 60 days	Degradation testing not applicable for metals/inorganics			
Half life fresh or estuarine water ≥ 40 days	Degradation testing not applicable for metals/inorganics			
Half life marine sediment ≥ 180 days	Degradation testing not applicable for metals/inorganics			
Half life fresh or estuarine sediment ≥ 120 days	Degradation testing not applicable for metals/inorganics			
Half life in soil ≥ 120 days	Degradation testing not applicable for metals/inorganics			
If answer to any question is YES, substance is persistent				
If answer to all questions is NO. substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)				
Is substance persistent?	**Yes**			Mercury is a metal. Metals do not degrade but transform into various species of varying toxicity, dependent upon environmental conditions (e.g. pH, redox, temperature). The persistence criteria were developed for organics. Metals and inorganics are inherently persistent and are subject to transformation rather than degradation.
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	Range of 5 to 4994	EU EQS dossier	Values given for mercury chloride BCFs in two species of fish. A geometric mean for BCF values in molluscs for inorganic mercury was 1750. For fish the geometric mean was noted to be 3050
Does field data show evidence for biomagnification?	Yes		EU EQS dossier	
If answer to either question is YES. substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	NA (see comment)			Log Kow values are not considered a reliable approach for assessing the potential for inorganic or most organometallic substances to bioaccumulate.
If answer is YES. substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not considered due to above			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative *If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained*				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**Yes**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.0007	EU EQS dossier	21d NOEC *Daphnia magna*. There are a number of invertebrate and fish chronic studies showing effect concentrations below the threshold of 0.01mg/l.
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	Yes	STOT RE1	ECHA C&L database	A number of mercury (II) compounds have been classified under C&L as STOT RE1 or RE2
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Repr 2	ECHA C&L database	A number of mercury (II) compounds have been classified under C&L. One of these, mercury dichloride, has been classified as Repr 2
If answer to any question is YES. substance is toxic				
If answer to all questions is NO. substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**Yes**			Mercury (II) is persistent in the environment, is of high toxicity and has the potential to bioaccumulate. The US EPA have identified mercury compounds as PBT.
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	See comment			Mercury is a metal. Metals do not degrade but transform into various species of varying toxicity, dependent upon environmental conditions (e.g. pH, redox, temperature). The persistence criteria were developed for organics. Metals and inorganics are inherently persistent and are subject to transformation rather than degradation.
Half life in marine, fresh or estuarine sediment ≥ 180 days	See comment			
Half life in soil ≥ 180 days	See comment			
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	Range of 5 to 4994	EU EQS dossier	Values given for mercury chloride BCFs in two species of fish. A geometric mean for BCF values in molluscs for inorganic mercury was 1750. For fish the geometric mean was noted to be 3050
If answer is yes. substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			Although the available data indicate it bioaccumulates it does not meet the criteria for vB
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	Yes	Muta 2	ECHA C&L database	A number of mercury (II) compounds have been classified under C&L. One of these ie mercury dichloride has been classified as Muta 2. Other mercury (II) compounds however do not have a classification for mutagenicity. Further information from an EFSA report indicates that certain forms of mercury have been found to show genotoxic effects in mammalian cells in vitro but that data from laboratory animals and humans is inconsistent. The most likely mechanism of genotoxicity appears to be via oxidative stress. which would be expected to be thresholded (EFSA. 2012).
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No (See comment)**			A number of mercury (II) compounds have been classified under C&L. One of these ie mercury dichloride has been classified as Muta 2. Other mercury (II) compounds however do not have a classification for mutagenicity. Further information from an EFSA report indicates that certain forms of mercury have been found to show genotoxic effects in mammalian cells in vitro but that data from laboratory animals and humans is inconsistent. The most likely mechanism of genotoxicity appears to be via oxidative stress, which would be expected to be thresholded (EFSA, 2012).
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**Meets the criteria for P, B and T**
Does substance have breakdown products of concern?	**No**			

REFERENCES

EU EQS dossier (2005)	https://circabc.europa.eu/sd/a/ff8e163c-71f6-4fc0-98ef-875a20add4c8/21_Mercury_EQSdatasheet_150105.pdf
ECHA C&L database	http://echa.europa.eu/information-on-chemicals/cl-inventory-database
EFSA (2012)	http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2012.2985/epdf
US EPA	https://www.epa.gov/toxics-release-inventory-tri-program/persistent-bioaccumulative-toxic-pbt-chemicals-covered-tri
UNEP	http://www.unep.org/PDF/PressReleases/GlobalMercuryAssessment2013.pdf

Molybdenum as the Molybdate anion ($[MoO_4]^{2-}$), covering (CAS Number: 32534-81-9):
Calcium Molybdate ($CaMoO_4$) (CAS No: 789-82-4);
Disodium molybdate ($NaMoO_4$) (CAS No: 7631-95-0)

The molybdate anion ($[MoO_4]^{2-}$) is released from molybdate salts. It has been demonstrated that upon dissolution in aquatic media, molybdenum substances of the valency states 0, +IV and +VI transform into the hexavalent molybdate anion (OECD SIDS). Although dissolution and transformation of metallic molybdenum will be limited, it is considered as a source of the molybdate anion. The molybdate anion is considered the relevant form for groundwater.

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	Test not applicable for			
Passes inherent biodegradation test	See above			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Test not applicable (see comment)			Degradation testing not applicable for metal/inorganic
Half life fresh or estuarine water ≥ 40 days	See above			
Half life marine sediment ≥ 180 days	See above			
Half life fresh or estuarine sediment ≥ 120 days	See above			
Half life in soil ≥ 120 days	See above			
Other relevant information (e.g. dissolution/transformation for metals/inorganics)				
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			The persistence criteria are not directly applicable to metals/inorganics and were developed principally for organic substances. Metals and inorganics such as molybdenum are inherently persistent and subject to transformation rather than degradation. Molybdenum will therefore not degrade but will be transformed depending on the local conditions.
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	0.05 - 71.6	OECD SIDS	Reported whole-body bioaccumulation factors for fish vary by more than 2 orders of magnitude (i.e., 0.05 – 71.6) but, as theoretically predicted for essential elements, there is a distinct close relationship between exposure concentration and BAF, i.e., decreasing BAFs with increasing Mo-levels in the water column, showing homeostatic control of Mo by these organisms. Similar findings are observed for aquatic invertebrate species. The homeostatic control of Mo in fish (O.mykiss) is observed to continue to function up to and within the milligram range of exposure. Bioaccumulation factors in the terrestrial compartment are situated around 0.2 - 4 for plants and 0.4 - 3.4 for invertebrates (drv weight basis).
Does field data show evidence for biomagnification?	No data			
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Test not applicable (see comment)			Log Kow are not considered reliable estimates of the potential for bioaccumulation of inorganic substances such as molybdenum.
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not considered due to data above			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.010 mg/l	No	8 mg/l	OECD SIDS	NOEC (20 day) *Acarita tonsa (invertebrate)*
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	No harmonised C&L classification for molybdate ion or molybdate compounds, eg disodium and calcium molybdate. Industry submissions to the C&L database suggest neither of these molybdate compounds meet the criteria. OECD SIDS assessment suggests low toxicity for the molybdate ion. Some effects following repeat dose oral exposure in the rat on sexual function, but effects only apparent at high dose.
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database	No harmonised C&L classification for molybdate ion or molybdate compounds, eg disodium and calcium molybdate. Industry submissions to the C&L database suggest neither of these molybdate compounds meet the criteria. OECD SIDS assessment suggests low toxicity for the molybdate ion. No effects in in vitro studies on mutagenicity (no in vivo studies available) or carcinogenicity (by inhalation, no oral study available). Some effects following repeat dose oral exposure in the rat on sexual function, but effects only apparent at high dose.
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**No**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet criteria for B or T**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Test not applicable (see comment)			The persistence criteria are not directly applicable to metals/inorganics and were developed principally for organic substances. Metals and inorganics such as molybdenum are inherently persistent and subject to transformation rather than degradation. Molybdenum will therefore not degrade but will be transformed depending on the local conditions.
Half life in marine, fresh or estuarine sediment ≥ 180 days	See above			
Half life in soil ≥ 180 days	See above			
If answer to any question is YES, substance is very persistent	Yes			
Is bioconcentration factor ≥ 5000	No	0.05 - 71.6	OECD SIDS	Reported whole-body bioaccumulation factors for fish vary more than 2 orders of magnitude (i.e., 0.05 – 71.6) but, as theoretically predicted for essential elements, there is a distinct close relationship between exposure concentration and BAF, i.e., decreasing BAFs with increasing Mo-levels in the water column, showing homeostatic control of Mo by these organisms. Similar findings are observed for aquatic invertebrate species. The homeostatic control of Mo in fish (O.mykiss) is observed to continue to function up to and within the milligram range of exposure. Bioaccumulation factors in the terrestrial compartment are situated around 0.2 - 4 for plants and 0.4 - 3.4 for invertebrates (dry weight basis).
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**	**not vB**		
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	Not assessed			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	No harmonised C&L classification for molybdate ion or molybdate compounds, eg disodium and calcium molybdate. Industry submissions to the C&L database suggest neither of these molybdate compounds meet the criteria. OECD SIDS assessment suggests low toxicity for the molybdate ion. No effects in in vitro studies on mutagenicity (no in vivo studies available) or carcinogenicity (by inhalation, no oral study available). Some effects following repeat dose oral exposure in the rat on sexual function, but effects only apparent at high dose.
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Does not meet criteria for P, B and T , nor vPvB or Very Toxic**
Does substance have breakdown products of concern?	**No**			

REFERENCES

ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database
OECD HPV SIDS assessment (2013) http://webnet.oecd.org/hpv/ui/SIDS_Details.aspx?id=ea0df388-a79d-4751-a6c1-d5cde948e7b0

Naphthalene (CAS: 91-20-3)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test				
Passes inherent biodegradation test	No		ESR (2003)	The ESR notes that it doesn't pass the reported inherent biodegradation study but that the available degradation studies (see below) indicate that it is quite degradable in aerobic environments.
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days				
Half life fresh or estuarine water ≥ 40 days	No	2days - 30days	ESR (2003)	A range of studies were reported in the ESR which indicated relatively rapid biodegradation in aerobic environments with degradation rates in the order of 2 - 30days. Slower rates were indicated for some anaerobic studies. Reports for groundwater degradation were variable with some reporting degradation in the order of about 15days and others indicating no degradation.
Half life marine sediment ≥ 180 days	No data			
Half life fresh or estuarine sediment ≥ 120 days	No	1- 70days	ESR (2003)	
Half life in soil ≥ 120 days	No	2 -<60days	ESR (2003)	
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**No**			**Overall the available data indicates it does not meet the persistence criteria. It may be more persistent in some conditions eg anaerobic**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	2.3-427	ESR (2003)	BCF values for fish (whole body). For individual tissues noted higher BCFs eg 1158 but still below the criterion
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	3 - 3.73	ESR (2003)	
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not considered due to above info			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	0.12	ESR (2003)	A range of chronic data is included in the ESR with the lowest value being 0.12mg/l which related to a 40d NOEC for Coho salmon
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RF2)\	No		ECHA C&L database	Harmonised C&L classification. The classification indicates it does not meet the criteria.
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No	Carc 2	ECHA C&L database	Harmonised C&L classification. The classification indicates it does not meet the criteria
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**No**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Doesn't meet criteria for P, B or T**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	No	2days - 30days	ESR (2003)	A range of studies were reported in the ESR which indicated relatively rapid biodegradation in aerobic environments with degradation rates n the order of 2 - 30days. Slower rates were indicated for some anaerobic studies but others indicated 90-100% reduction in 50-60days
Half life in marine, fresh or estuarine sediment ≥ 180 days	No	1- 70days	ESR (2003)	
Half life in soil ≥ 180 days	No	2 -<60days	ESR (2003)	
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	2.3-427	ESR (2003)	
If answer is ves. substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Doesn't meet criteria for vP or vB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?				
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous	Not assessed			
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	Harmonised C&L classification
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			
Does substance have breakdown products of concern?	**No**			

REFERENCES

ESR (2003) http://echa.europa.eu/documents/10162/4c955673-9744-4d1c-a812-2bf97863906a
ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database
WFD EQS dossier (2012) https://circabc.europa.eu/sd/a/2fc1dfd1-fc77-44af-9d23-2a0c1735ce6d/Naphthalene%20EQS%20dossier%202011.pdf

Nickel as Nickel (II)

The Nickel (II) ion will predominate in the freshwater environment. There are a number of soluble Ni (II) compounds including nickel hydroxide, sulphate and carbonate.

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent. bioaccumulative and toxic?				
Persistence				
Passes ready biodegredation test	Test not applicable for metals/inorganics			
Passes inherent biodegredation test	See above			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Degradation testing not applicable for metals/inorganics			
Half life fresh or estuarine water ≥ 40 days	See above			
Half life marine sediment ≥ 180 days	See above			
Half life fresh or estuarine sediment ≥ 120 days	See above			
Half life in soil ≥ 120 days	See above			
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)				
Is substance persistent?	**Yes**			**The persistence criteria are not directly applicable to metals/inorganics and were developed principally for organic substances. Metals and inorganics such as nickel are inherently persistent and subject to transformation rather than degradation. Nickel will therefore not degrade but will be transformed depending on the local conditions.**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	<340	ESR (2008)	The majority of the BCF values were noted to be below 340. One mollusc Cerastoderm edule showed high bioaccumulation but this result was significantly different to the other organisms studied including other molluscs.
Does field data show evidence for biomagnification?	No		ESR (2008)	Assessment of the available data for the ESR indicated nickel does not biomagnify
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Not applicable (see comment)			Log Kow values are not considered reliable estimates of the bioaccumulation potential of inorganic substances such as nickel.
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not considered due to the above data			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			**Based on the available BCF and biomagnification data nickel (II) is not conisdered to meet the bioaccumulation criteria**
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.0014mg/l	ESR (2008)	30d EC10 *Lymnaea stagnalis*
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	Yes	STOT RE1	ECHA C&L database	A number of nickel (II) compounds have been classified under C&L and have been determined as STOT RE1.
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Repr 1B	ECHA C&L database	A number of nickel (II) compounds have been classified under CLP and have been determined as Repr 1B
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet criteria for B**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	See comment			The persistence criteria are not directly applicable to metals/inorganics and were developed principally for organic substances. Metals and inorganics such as nickel are inherently persistent and subject to transformation rather than degradation. Nickel will therefore not degrade but will be transformed depending on the local conditions.
Half life in marine, fresh or estuarine sediment ≥ 180 days	See comment			
Half life in soil ≥ 180 days	See comment			
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	<340	ESR (2008)	The majority of the BCF values were noted to be below 340. One mollusc Cerastoderm edule showed high bioaccumulation but this was significantly different to the other organisms studied.
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Does not meet the criteria for vB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	Yes	Muta 2	ECHA C&L database/EFSA (2015)	A number of nickel (II) compounds have been classified under C&L and have been determined as Muta 2. The weight of evidence from the European Food Safety Authority (2015) indicates that the genotoxicity and mutagenicity of nickel is likely to occur via indirect mechanisms. This means that it is considered that nickel does not interact directly with the DNA in human cells, and thus a threshold can be assumed for its observed genotoxicity/mutagenicity. It is therefore considered not to meet the criteria for Very Toxic
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No (see comment)**			**Although classified as Muta 2 under C&L it is considered that nickel has a threshold for genotoxic effects via oral exposure and therefore not to meet the criteria for Very Toxic**
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Does not meet criteria for PBT or vPvB. Is determined as Muta 2 under C&L however it is considered to have a threshold for genotoxic effects and therefore not considered to meet the criteria for determination as Hazardous**
Does substance have breakdown products of concern?	**No**			

REFERENCES

ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database
ESR (2008) http://echa.europa.eu/documents/10162/cefda8bc-2952-4c11-885f-342aacf769b3
WHO (2005) http://www.who.int/water_sanitation_health/dwq/wsrevision/nickel2005.pdf
EFSA (2015) http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2015.4002/epdf

Pentachlorobenzene (CAS Number: 608-93-5)

	Yes / No / Insuffient data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	No		POPRC (2007)	The result from an OECD TG 301C test showed pentachlorobenzene was non-biodegradable
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	NA			
Half life fresh or estuarine water ≥ 40 days	Yes	194-1250 days	POPRC (2007)	Values recorded for surface water. Not clear if marine, estuarine or freshwaters.
Half life marine sediment ≥ 180 days	NA			
Half life fresh or estuarine sediment ≥ 120 days				
Half life in soil ≥ 120 days	Yes	260-7300 days	POPRC (2007)	In a UK soil (Woburn) that received sludge applications until 1961, approximately 21% of the added pentachlorobenzene was still in the soil 30 years later.
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			**Pentachlorobenzene has been designated as a Persistent Organic Pollutant (POP)**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	577-23000	POPRC (2007)	BCF range for fish, mollusca and crustacea. Many of the results for invertebrates and fish are >2000
Does field data show evidence for biomagnification?	Insufficient data		POPRC (2007)	Potential for biomagnification is considered high. Much field biota data exist but no agreed BMF values.
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Yes	5.17	POPRC (2007)	Values range from 4.88-6.12 with recommended values of 5.17-5.18
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed due to the information being available			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**Yes**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.010 mg/l	Yes	2 ug/L (0.002 mg/L)	POPRC (2007)	Freshwater fish species
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	EU harmonised C&L classification available. The classification indicates the criteria are not met
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database	EU harmonised C&L classification available. The classification indicates the criteria are not met
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			**Based on aquatic toxicity**
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**Yes**			**Meets the criteria for P, B and T. Pentachlorobenzene has been designated as a Persistent Organic Pollutant (POP)**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes	194-1250 days	POPRC (2007)	Values recorded for surface water. Not clear if marine, estuarine or freshwaters.
Half life in marine, fresh or estuarine sediment ≥ 180 days				
Half life in soil ≥ 180 days	Yes	260-7300 days	POPRC (2007)	In a UK soil (Woburn) that received sludge applications until 1961, approximately 21% of the added pentachlorobenzene was still in the soil 30 years later.
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	Yes	577-23000	POPRC (2007)	BCF range for fish, mollusca and crustacea. Many of the results for fish are >2000
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**Yes**			**Meets the criteria for vPvB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	EU harmonised C&L classification. The classification indicates that pentachlorobenzene do not meet these criteria
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**Meets the criteria for P, B and T as well as for vP, vB. Pentachlorobenzene is a designated Persistent Organic Pollutant (POP)**
Does substance have breakdown products of concern?	**No**			

REFERENCES

POPRC. 2007. Draft risk profile for Pentachlorobenzene http://www.pops.int/documents/meetings/poprc/drprofile/drp/DraftRiskProfile_PeCB.pdf

ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database

PFOS (CAS: 1763-23-1)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	No		OECD (2002), Environment Canada (2006)	Studies on PFOS show it is not readily degraded. No degradation was observed over 28days in a MITI test.
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days				The available data indicated that PFOS is not degraded via biodegradation, photodegradation or hydrolysis and it is persistent in the environment. A half life of >41years was estimated (Environment Canada 2006). It has been identified as a POP (Persistent Organic Pollutant)
Half life fresh or estuarine water ≥ 40 days				
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days				
Half life in soil ≥ 120 days				
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			**PFOS has been identified as a Persistent Organic Pollutant (POP)**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	1124 - 4013	OECD (2002)	Range of BCF values reported for the bluegill sunfish. A range of 200 - 1500 was reported for carp
Does field data show evidence for biomagnification?	Yes		Environment Canada (2006)	A number of studies are reported which show biomagnification of PFOS in the food chain including studies of accumulation in the Arctic and Great Lakes.
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No data			It is noted that it is not possible to measure the Log Kow of PFOS due to its properties. It is generally present as an anion at environmental pH and determination of a Log Kow is not appropriate
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not assessed due to above data			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**Yes**			Based on both BCF data and reported evidence of biomagnification
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	0.25	OECD (2002)	35d NOEC of 0.25mg/l for *Mysidopsis bahia*
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	Yes	STOT RE1	ECHA C&L database	Harmonised C&L classification is available for PFOS. The classification shows it meets the criteria for STOT RE2
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Repr 1B	ECHA C&L database	Harmonised C&L classification. The classification shows it meets the criteria for Repr 1B
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			Meets criteria for STOT RE1 and Repr 1B
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**Yes**			Meets criteria for P, B and T
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes		OECD (2002), Environment Canada (2006)	Although very little specific half life data is available information located indicated PFOS does not degrade via biodegradation, photodegradation and that hydrolysis if very slow with a half life estimated of >41years.
Half life in marine, fresh or estuarine sediment ≥ 180 days				
Half life in soil ≥ 180 days				
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	1124 - 4013	OECD (2002)	Whole body BCFs above 5000 are not generally reported. However the weight of evidence indicates it is highly bioaccumulative and has been found to biomagnify
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Does not meet the threshold for BCF data although the substance has been found to biomagnify**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	Harmonised C&L classification
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**Meets the criteria for P, B and T. PFOS has been identified as a POP (Persistent Organic Pollutant)**
Does substance have breakdown products of concern?	**No**			

REFERENCES

ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database
Environment Canada (2006) Ecological Screening Assessment Report on PFOS http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=98B1954A-1
Environment Agency (2004) Environmental Risk Evaluation Report - PFOS https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/290857/scho1009brbl-e-e.pdf
OECD (2002) Hazard Assesssment of PFOS and its salts http://www.oecd.org/chemicalsafety/risk-assessment/2382880.pdf
Persistent Organic Pollutant Tool Kit http://www.popstoolkit.com/about/chemical/pfos.aspx

Propylene glycol (CAS: 57-55-6)

	Yes / No / Insufficient data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	Yes		OECD SIDS (2001)	A number of studies reported that propylene glycol is readily biodegradable. Two studies in sludge were noted in the SIDS report. One reported 79% after 20d and another 84-99% after 24hr. In soil a study reported 100% degradation after 12days.
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days				
Half life fresh or estuarine water ≥ 40 days				
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days				
Half life in soil ≥ 120 days				
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**No**			
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	1.4	OECD SIDS (2001)	A BCF of 1.4 was calculated from the log Kow
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	-1.41 and -0.3'	OECD SIDS (2001)	
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not considered due to the above information			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	13020	OECD SIDS (2001)	The value noted is a 7d NOECreproduction for the invertebrate Ceriodaphnia dubia. This indicates low chronic toxicity to this species. Chronic data for algal species also indicated that it would not meet the criteria with 14d NOECs of <5300mg/l reported. No chronic data was available for fish but the acute data for fish indicate low toxicity with acute effects reported in the range of 46500 - 51600mg/l. This acute data and the chronic data available indicate propylene glycol does not meet the criteria for chronic toxicity to aquatic life.
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database/SIDS (2001)	An EU harmonised C&L classification is not available for propylene glycol. Industry data submitted to the ECHA database indicates that it does not meet these criteria. This is supported by data presented in the SIDS assessment where the data provided did not indicate effects from long term exposure.
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database/SIDS (2001)	An EU harmonised C&L classification is not available for propylene glycol. Industry data submitted to the ECHA database indicates that it does not meet these criteria. This is supported by data presented in the SIDS assessment where the data provided did not indicate any evidence of carcinogenic or genotoxic effects and no evidence of reproductive or developmental toxicity.
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**No**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Available data indicates it does not meet the criteria for P, B or T**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	No			A number of studies reported that propylene glycol is readily biodegradable. Two studies in sludge were noted in the SIDS report. One reported 79% after 20d and another 84-99% after 24hr. In soil a study reported 100% degradation after 12days.
Half life in marine, fresh or estuarine sediment ≥ 180 days				
Half life in soil ≥ 180 days				
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	1.4	OECD SIDS (2001)	A BCF of 1.4 was calculated from the log Kow
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Does not meet the criteria for either vP or vB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?				
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	Not assessed			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No			An EU harmonised C&L classification is not available for propylene glycol. Industry data submitted to the ECHA database indicates that it does not meet these criteria. This is supported by data presented in the SIDS assessment where the data provided did not indicate any evidence of genotoxic effects.
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			

Does substance have breakdown products of concern? **No**

REFERENCES

OECD SIDS (2001) http://www.inchem.org/documents/sids/sids/57-55-6.pdf

ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database?p_p_id=disclinventory_WAR_disclinventoryportlet&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-1&p_p_col_pos=1&p_p_col_count=2

Selenium (CAS: 7782-49-2)

"Acidic and reducing conditions reduce inorganic selenites to elemental selenium; alkaline and oxidizing conditions favour the formation of selenates. Selenites and selenates are soluble in water, selenium is leached from well-aerated alkaline soils that favour its oxidation. In contrast, elemental selenium and selenides are insoluble in water; therefore, selenium tends to be retained in wet, poorly aerated soils, the reducing conditions of which favour those forms. Thus, selenium in alkaline soils is available for uptake by plants, whereas the availability of selenium in acidic soils tends to be limited by the adsorption of selenites and selenates to iron and aluminium oxide sols." (WHO 2011)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	Test not applicable (see comment)			Test not applicable to metals/inorganics
Passes inherent biodegradation test	Test not applicable (see comment)			Test not applicable to metals/inorganics
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Test not applicable (see comment)			Degradation testing not applicable for metal/inorganic
Half life fresh or estuarine water ≥ 40 days	See above			
Half life marine sediment ≥ 180 days	See above			
Half life fresh or estuarine sediment ≥ 120 days	See above			
Half life in soil ≥ 120 days	See above			
Other relevant information (e.g. dissolution/transformation for metals/inorganics)				
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)				
Is substance persistent?	**Yes (see comment)**			**The persistence criteria are not directly applicable to metals/inorganics and were developed principally for organic substances. Metals and inorganics such as selenium are inherently persistent and subject to transformation rather than degradation. Selenium will therefore not degrade but will be transformed depending on the local conditions.**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	<2000	ECHA-CHEM	Selenium is an essential element and internal concentrations are regulated in many aquatic organisms . Higher accumulation is reported in lower trophic levels eg algae. Accumulation in fish and other higher trophic levels mainly results from dietary uptake. A range of BCF values have been reported. Some of these in lower trophic levels (eg algae) exceed the threshold of 2000, and there is some evidence for dose dependency. The majority of BCF data for fish and invertebrates are below the threshold of 2000. Therefore, based on a weight of evidence approach coupled with likely dose dependency of this essential element, selenium is considered not to bioaccumulate according to the criterion.
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	Test not applicable (see comment)			Log Kow are not considered reliable estimates of the potential for bioaccumulation of inorganic substances such as selenium.
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not considered due to the above data on bioaccumulation			
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	0.085mg/l	Ecotox	The lowest chronic study was a 21d NOEC for *Daphnia magna*
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	Yes	STOT RE2	ECHA C&L database	Harmonised C&L classification. The classificaiton indicates it met the criteria for STOT RE2
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database	Harmonised C&L classification. The classification indicates it does not meet the criteria
If answer to any question is YES, substance is toxic				
If answer to all questions is NO. substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet the criteria for bioaccumulation**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Test not applicable (see comment)			
Half life in marine, fresh or estuarine sediment ≥ 180 days	See above			The persistence criteria are not directly applicable to metals/inorganics and were developed principally for organic substances. Metals and inorganics such as selenium are inherently persistent and subject to transformation rather than degradation. Selenium will therefore not degrade but will be transformed depending on the local conditions.
Half life in soil ≥ 180 days	See above			
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	<2000	ECHA-CHEM	Selenium is an essential element and internal concentrations are regulated in many aquatic organisms . Higher accumulation is reported in lower trophic levels eg algae. Accumulation in fish and other higher trophic levels mainly results from dietary uptake. A range of BCF values have been reported. Some of these in lower trophic levels (eg algae) exceed the threshold of 2000, and there is some evidence for dose dependency. The majority of BCF data for fish and invertebrates is below the threshold of 2000. Therefore, based on a weight of evidence approach coupled with likely dose dependency of this essential element, selenium is considered not to bioaccumulate according to the criterion.
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Does not meet criteria for vB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	Harmonised C&L classification. The classification indicates it does not meet the criteria for mutagenicity
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			Also relevant for this determination: The United Kingdom Expert Group on Vitamins and Minerals recommended selenium intakes of 60 µg/day for women and 70 µg/day for men (UK EGVM, 2002). However because of concern about the adverse effects from exposure to excessive levels of selenium, same body established upper limit of 400 ug/l for selenium. This guidance indicates that selenium does not meet the criteria for 'no determinable threshold'.
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Substance is persistent and toxic (based on STOT RE2) but is not considered bioaccumulative and does not display an equivalent level of concern according to the criteria.**
Does substance have breakdown products of concern?	**No**			

REFERENCES

WHO (2011) http://www.who.int/water_sanitation_health/dwq/chemicals/selenium.
ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-
US EPA Ecotox database http://cfpub.epa.gov/ecotox/
ECHA CHEM http://apps.echa.europa.eu/registered/data/dossiers/DISS-e18edfe9-

Tetrachloroethylene (CAS: 127-18-4)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	No	11% degradation after 28days	ECHA (2014)	The ECHA (2014) report noted that based on consideration of the available studies tetrachloroethylene is not considered to be readily biodegradable
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Yes		ESR (2005)	The summary information provided in the EU risk assessment indicates hydrolysis and photolysis are not key processes but volatilisation is with half lives reported in the range of 3hrs - 14days. Aerobic biodegradation is noted to be very slow however no specific half lives were given. Degradation is reported under anaerobic conditions however again specific half lives are not given. Based on the available data tetrachloroethylene is considered to be persistent. This is supported in the ECHA(2014) which notes that based on the available information tetrachloroethylene meets the criteria for P and vP
Half life fresh or estuarine water ≥ 40 days				
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days				
Half life in soil ≥ 120 days				
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			**The available data indicate that tetrachloroethylene meets the criteria for persistence. This is supported by the ECHA (2014) document which notes the available data support tetrachloroethylene meeting the P and vP data.**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	40-50	ESR (2005)	The data in the ESR is supported by that in the Canadian risk assessment report which noted BCFs for fish ranging from 40 - 400.
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	2.53	ESR (2005)	The value in the ESR report is supported by a value of 3.4 reported in the NICNAS report. The available data indicates it does not meet the criteria.
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not assessed due to above information			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative *If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers). BCF data should be obtained*				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	0.51mg/l	ESR (2005)	Lowest reliable chronic study was noted to be a 28d NOEC for *Daphnia magna* of 0.51mg/l
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	Harmonised C&L classification. The classification indicates it does not meet the criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No	Carc 2	ECHA C&L database	Harmonised C&L classification. The classification indicates it does not meet the criteria
If answer to any question is YES, substance is toxic *If answer to all questions is NO, substance is not toxic*				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**No**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet criteria for B or T**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes		ESR (2005)	The summary information provided in the EU risk assessment indicates hydrolysis and photolysis are not key processes but volatilisation is with half lives reported in the range of 3hrs - 14days. Aerobic biodegradation is noted to be very slow however no specific half lives were given. Degradation is reported under anaerobic conditions however again specific half lives are not given. Based on the available data tetrachloroethylene is considered to be persistent
Half life in marine, fresh or estuarine sediment ≥ 180 days				
Half life in soil ≥ 180 days				
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	40-50	ESR (2005)	
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Does not meet criteria for vB**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?				
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database/WHO	Harmonised C&L classification. The classification indicates it does not meet the criteria for mutagenicity. WHO report notes that evidence indicates that although carcinogenic it is not genotoxic and therefore does not meet the 'no determinable effects' criteria
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Tetrachloroethylene does not meet the criteria for determination as Hazardous.** ***NB. Known breakdown products following anaerobic degradation include trichloroethylene (determined as Hazardous) and vinyl chloride (determined as Hazardous).***
Does substance have breakdown products of concern?	***Yes - trichloroethylene (determined as Hazardous) and vinyl chloride (determined as Hazardous)***			

REFERENCES

ESR (2005) EU risk assessment report - tetrachloroethylene	http://echa.europa.eu/documents/10162/130bc4f2-68a8-45d8-88d7-e6db88f76a98
ECHA C&L database	http://echa.europa.eu/information-on-chemicals/cl-inventory-database
Canadian Risk Assessment	http://www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/contaminants/psl1-lsp1/tetrachloroethylene/tetrachloroethylene-eng.pdf
WHO (2003) Tetrachloroethene in drinking water	http://www.who.int/water_sanitation_health/dwq/chemicals/tetrachloroethene.pdf
ECHA (2014)	https://echa.europa.eu/documents/10162/08ebe33b-736e-49b2-9537-f425b05c2a82
NICNAS risk assessment	http://www.nicnas.gov.au/__data/assets/pdf_file/0020/4376/PEC_15_Tetrachloroethylene_Full_Report_PDF.pdf

Thallium (as Thallium I)

Thallium is most commonly found in the freshwater aquatic environment as Thallium (I) and the thallium compounds used are predominantly in the Thallium (I) form. This assessment has been based on data for Thallium (I) forms of thallium including thallium sulphate, thallium oxide, thallium hydroxide, thallium chloride. Many thallium (I) compounds are noted to be very soluble in water, eg thallium (I) hydroxide, sulphate and carbonate.

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegredation test	Test not applicable for			
Passes inherent biodegredation test	See above			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Degradation testing n/a for metals/inorganics			
Half life fresh or estuarine water ≥ 40 days	See above			
Half life marine sediment ≥ 180 days	See above			
Half life fresh or estuarine sediment ≥ 120 days	See above			
Half life in soil ≥ 120 days	See above			
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)				
Is substance persistent?	**Yes**			Thallium is a metal. Metals do not degrade but transform into various species of varying toxicity, dependent upon environmental conditions (e.g. pH, redox, temperature). The persistence criteria were developed for organics. Metals and inorganics are inherently persistent and are subject to transformation rather than degradation.
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	27-235	CCME (1999)	Limited information is available on the bioaccumulation potential of thallium. Data reported by CCME provides BCF data for fish. This data does not meet the criteria. BCFs reported for duckweed are much higher but are not considered appropriate for consideration against the criteria due to the uptake of thallium by plants. The EHC report (1996) indicates higher levels of thallium are found in fish from contaminated areas than in uncontaminated but this does not provide robust evidence of bioaccumulation.
Does field data show evidence for biomagnification?	Insufficient data		INRS (2011)	The INRS report indicates that prey may be an important source of thallium and can be efficiently transferred from prey to predator but no specific evidence is provided re: biomagnification.
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	NA (see comment)			Log Kow are not considered reliable estimates of the potential for bioaccumulation of inorganic substances such as thallium
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?	Not considered due to the above information			
Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100u/mol Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)				
Is substance bioaccumulative?	**No**			**The available data do not provide sufficient evidence that thallium meets the criteria for bioaccumulation**
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Borderline	0.014mg/l	EHC (1996) and CCME (1999)	Study on *Lemna minor* . Although one study documented in both the EHC and CCME report indicated a toxicity endpoint below the criteria of 0.01mg/l for Lemna minor the majority of the toxicity results were above the 0.01mg/l threshold. Studies on fish and aquatic plants/algae showed effects in the 10s ug/l ie close to the threshold but only one study noted a chronic endpoint below the threshold
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	Yes	STOT RE2	ECHA C&L database	A number of Thallium (I) compounds have been classified under C&L and have been determined as STOT RE2. Thallium (I) sulphate was determined STOT RE1
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		ECHA C&L database	A number of Thallium (I) compounds have been classified under C&L. None were classified as CMR
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			**Based on STOT RE2**
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet the criteria for bioaccumulation**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	(See comment)			Thallium is a metal. Metals do not degrade but transform into various species of varying toxicity, dependent upon environmental conditions (e.g. pH, redox, temperature). The persistence criteria were developed for organics. Metals and inorganics are inherently persistent and are subject to transformation rather than degradation.
Half life in marine, fresh or estuarine sediment ≥ 180 days	(See comment)			Degradation testing n/a for metals/inorganics
Half life in soil ≥ 180 days	(See comment)			Degradation testing n/a for metals/inorganics
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	27-235	CCME (1999)	Limited information is available on the bioaccumulation potential of thallium. Data reported by CCME provides BCF data for fish. This data does not meet the criteria. BCFs reported for duckweed are much higher but are not considered appropriate for consideration against the criteria due to the uptake of thallium by plants. The EHC report (1996) indicates higher levels of thallium are found in fish from contaminated areas than in uncontaminated but this does not provide robust evidence of bioaccumulation.
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Does not meet the criteria for bioaccumulation**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database	A number of Thallium (I) compounds have been classified under C&L. None were classified as mutagenic
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Does not meet the criteria for PBT, vPvB or Very Toxic**
Does substance have breakdown products of concern?	**No**			

REFERENCES

CCME (1999) Canadian Environmental Quality Guidelines for the Protection of A http://ceqg-rcqe.ccme.ca/download/en/215
INRS (2011) Critical Review of Thallium in Aquatic Ecosystems http://espace.inrs.ca/830/1/R001272.pdf
ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database
EHC (1996) http://www.inchem.org/documents/ehc/ehc/ehc182.htm

Tributyl tin as TBT ion and (soluble) hydroxide complex, covering Tributyltin (CAS: 36643-28-4); bis(tributyltin) oxide (CAS: 56-35-9)

TBT moiety most relevant for groundwater assessment. Exchangable ligands on the tin atom - TBT chloride etc - will form the hydroxide in solution, so assessment should focus on the TBT moiety of concern. (ECHA, CICAD 14)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent. bioaccumulative and toxic?				
Persistence				
Passes ready biodegredation test				
Passes inherent biodegredation test				
If answer to either question is YES, substance is not persistent *If answer to both questions is NO, additional data on half life is required*				
Half life marine water ≥ 60 days				
Half life fresh or estuarine water ≥ 40 days	Yes	70days	ECHA (2008)	The degradation of TBTO involves the splitting of the carbon-tin bond. This can result from various processes -- both physicochemical (hydrolysis and photodegradation) and biological (degradation by microorganisms and metabolism by higher organisms) -- occurring simultaneously in the environment. Although the hydrolysis of organotin compounds occurs under conditions of extreme pH, it is barely evident under normal environmental conditions (CICAD 14).
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days	Yes	>1-15years	ECHA (2008)	
Half life in soil ≥ 120 days	Yes	323days	ECHA (2008)	Half life at 12oC. Half life of 114days reported at 25oC
If answer to any question is YES, substance is persistent *If answer to all questions is NO, substance is not persistent*				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			**The available data indicates it meets the criteria for persistence and the ECHA SVHC report concluded it met the criteria for persistence.**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	>2000 in fish	ECHA (2008)	Bioconcentration of TBT expected to increase with increasing pH in the range 6-8 (increasing dominance of non-ionic complexes). Eg BCF in freshwater carp (Cyprinus carpio) increased from 1190 at pH 6.0 to 2250 at pH 7.8.
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	3.2 - 4.05	ECHA (2008)	
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not assessed due to above data			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative *If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers). BCF data should be obtained*				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**Yes**			**The available data indicates it meets the criteria for bioaccumulation. The ECHA SVHC document concluded that it met the criteria for B.**
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	Yes	0.00015mg/l	ECHA (2008)	*Daphnia magna* chronic NOEC
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	Insufficient data		ECHA C&L database	No EU harmonised C&L classification. Industry submissions to the ECHA C&L database for bis(tributyltin)oxide indicates STOT RE1 and RE2
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Reor 1A, 1B, 2)	Insufficient data		ECHA C&L database	No EU harmonised C&L classification. Industry submissions to the ECHA C&L database for bis(tributyltin)oxide do not indicate it meets these criteria
If answer to any question is YES, substance is toxic *If answer to all questions is NO, substance is not toxic*				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			**High chronic aquatic toxicity. The ECHA SVHC report concluded it met the criteria for T.**
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**Yes**			It meets the criteria for P, B and T. TBTO has been classified as a PBT compound under REACH and has been designated an SVHC (EHCA 2008)
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes	70days	ECHA (2008)	
Half life in marine, fresh or estuarine sediment ≥ 180 days	Yes	>1-15years	ECHA (2008)	
Half life in soil ≥ 180 days	Yes	323days	ECHA (2008)	Half life at 12oC. Half life of 114days reported at 25oC
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	<5000	ECHA (2008)	Weight of evidence approach. BCFs likely between 2000 and 5000 at relevant pH values
If answer is ves. substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database; CICAD	No harmonised C&L classification. Industry submissions to the ECHA C&L database do not indicate Muta 1A, 1B or 2. Conclusion in the CICAD review was that TBT is not gentoxic
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)				
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**Has been classified as a Substance of Very High Concern in REACH as it has been determined to be a PBT substance.**
Does substance have breakdown products of concern?	**No**			

REFERENCES

ECHA SVHC support document - TBTO (2008) https://echa.europa.eu/documents/10162/52f3fc94-c78f-436f-98ca-e0f845f37a9a
WHO CICAD no. 14 (TBTO) (1999) http://www.inchem.org/documents/cicads/cicads/cicad14.htm
ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database

Trichlorobenzenes (CAS: 12002-48-1);
Based on 1,2,4-Trichlorobenzene (CAS: 120-82-1)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	Borderline		EU RAR (2003)	Weight of evidence indicates not readily biodegradable
Passes inherent biodegradation test	Borderline	56 % (5 days)	EU RAR (2003)	Based on BOD 5.
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Yes (see comment)		EU RAR (2003)	No experimental half life data was available. However a half life of 150days has been estimated.
Half life fresh or estuarine water ≥ 40 days	Yes (see comment)		EU RAR (2003)	A study was reported in seawater which showed a half life of 22days however the route of removal was reported to be volatilisation rather than biodegradation therefore no degradation half lives were available. Volatilisation is a key removal process for trichlorobenzene however this is not relevant for an assessment in relation to groundwater.
Half life marine sediment ≥ 180 days	Yes	202 - 212 days	EU RAR (2003)	Measured value from an anaerobic sediment-water test system
Half life fresh or estuarine sediment ≥ 120 days	Yes (see comment)		EU RAR (2003)	No experimental half life data was available. However a half life of 300days has been estimated.
Half life in soil ≥ 120 days	Yes (see comment)		EU RAR (2003)	No experimental half life data was available. However a half life of 300days has been estimated.
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			As weight of evidence indicated not readily biodegraded and estimated data indicated half lives which meet the criteria, trichlorobenzene is noted to be meet the criteria for persistence
Is substance persistent?	**Yes**			**Although limited measured degradation half life data was available the weight of evidence indicates it meets the persistence criteria.**
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	Yes	120 - 3200	EU RAR (2003)	Several studies in fish available; upper bound value taken as worst case. Majority of the results were <2000 though.
Does field data show evidence for biomagnification?	No	<1	EU RAR (2003)	Low potential for biomagnification for mammals
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	4.05	EU RAR (2003)	Available Log Kow values ranged from 2.33 - 4.8. A value of 4.05 was chosen for use in the risk assessment as greater weight was given to direct measurement rather than HLPC method and the 'slow stirring' method preferred in this case.
If answer is YES. substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not assessed as above data available			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**Yes**			**This is based on the BCF data. It is noted that the majority of the BCF values available are <2000 however the upper BCF value has been used for the assessment.**
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01 mg/l	No	0.04 mg/L	EU RAR (2003)	Lowest NOEC (21d) for *Brachydario rerio* (fish).
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		EU RAR / ECHA C&L	EU harmonised C&L classification for 1,2,4-trichlorobenzene available. The classification indicates it does not meet the criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	No		EU RAR / ECHA C&L	EU harmonised C&L classification for 1,2,4-trichlorobenzene available. The classification indicates it does not meet the criteria
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**No**			
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet criteria for T**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes (see comment)		EU RAR (2003)	A study was reported in seawater which indicated a half life of 22 days. However the main route of removal was reported to be volatilisation rather than degradation and therefore the half life reported is taken as a representation of a degradation half life. Volatilisation is a key removal process but is not considered relevant here as the assessment is in relation to groundwater. No experimental half life data was available. However a half life of 150days has been estimated.
Half life in marine, fresh or estuarine sediment ≥ 180 days	Yes	202 - 212 days	EU RAR (2003)	Measured value fron an anaerobic sediment-water test system
Half life in soil ≥ 180 days	Yes (see comment)		EU RAR (2003)	No experimental half life data was available. However a half life of 300days has been estimated.
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	120 - 3200	EU RAR (2003)	Several studies in fish available; upper bound value taken as worst case
If answer is yes. substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**	**Only vP**		
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		EU RAR / ECHA C&L	EU harmonised C&L classification for 1,2,4-trichlorobenzene available. The classification indicates it does not meet the criteria for mutagenicity. WHO (2004) noted that none of the isomers were considered genotoxic
If answer to any question is YES. substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**No**			
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**No**			**Does not meet criteria for persistence, bioaccumulation or toxicity nor the criteria for equivalent concern**
Does substance have breakdown products of concern?	**No**			

REFERENCES

EU Risk Assessment Report (2003) 1,2,4-trichlorobenzene. http://echa.europa.eu/documents/10162/44180838-c246-4d42-9732-45e2af411e52
ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-data
WHO (2004) http://www.who.int/water_sanitation_health/dwq/chemicals/trichlorobenzenes.pdf

Trichloroethylene (CAS: 79-01-6)

	Yes / No / Insufficent data / Borderline / assume yes or no?	Value	Reference	Comments
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	No		ESR (2004)	Available studies indicate that trichloroethylene is not readily biodegradable
Passes inherent biodegradation test				
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	Yes		ESR (2004)	ESR noted available studies showed no degradation in seawater
Half life fresh or estuarine water ≥ 40 days	Yes	>8weeks	ESR (2004)	ESR noted that degradation in aerobic conditions was very slow unless in the presence of acclimated microbes or another substrate. Some degradation in anaerobic conditions has been reported however studies suggest the degradation rate is still slow. Volatilisation is thought to be the main route of removal from surface water rather than degradation. Based on the available data the ESR concluded that trichloroethylene is persistent.
Half life marine sediment ≥ 180 days				
Half life fresh or estuarine sediment ≥ 120 days				
Half life in soil ≥ 120 days				
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)	Yes			
Is substance persistent?	**Yes**			
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	17-90	ESR (2004)	Range of BCF values reported for whole fish in the ESR. All below the threshold of 2000.
Does field data show evidence for biomagnification?				
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	2.29	ESR (2004)	A number of similar values have been reported. This value has been used as it is the study chosen for use in the ESR. It is a measured value
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely? Substance is chronically non-toxic in mammals Molecular size ≥ 4.3nm Molecular weight ≥ 1100g/mol Octanol solubility ≤ 0.002mmol/l	Not assessed due to above data			
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No	5.76mg/l	ESR (2004)	Lowest reliable chronic value included in the ESR. This is for a chronic study on the fish Jordanella floridae. Some invertebrate data showed slightly lower effect concentrations but the studies were not considered reliable. These lower values however were still above the threshold of 0.01mg/l
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	Harmonised C&L classification for trichloroethylene. The classification indicates it does not meet the criteria
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Reor 1A, 1B, 2)	Yes	Carc 1B	ECHA C&L database	Harmonised C&L classification for trichloroethylene. The classification indicates it does meet the criteria
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			**Based on Carc 1B**
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet the criteria for B although does for persistence and toxicity**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes		ESR (2004)	ESR noted that degradation in aerobic conditions was very slow unless in the presence of acclimated microbes or another substrate. Some degradation in anaerobic conditions however studies suggest the degradation rate is still slow. Volatilisation is thought to be the main route of removal from surface water rather than degradation. Based on the available data the ESR concluded that trichloroethylene is persistent.
Half life in marine, fresh or estuarine sediment ≥ 180 days				
Half life in soil ≥ 180 days				
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	17-90	ESR (2004)	Range of BCF values reported in the ESR however all indicated BCFs below the criterion
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Doesn't meet criteria for bioaccumulation**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?	Not assessed			
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	Yes	Muta 2	ECHA C&L database	Harmonised C&L classification for trichloroethylene
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**Yes**			**Very Toxic due to Muta 2.**
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**Hazardous based on Muta 2 which results in Very Toxic classification.** **NB: *Available information indicates it can degrade in groundwater to form vinyl chloride (determined as Hazardous).***
Does substance have breakdown products of concern?	**Yes - Vinyl chloride (which has been determined as Hazardous)**			

REFERENCES

EU ESR 2004 - Risk Assessment for Trichloroethylene http://echa.europa.eu/documents/10162/83f0c99f-f687-4cdf-a64b-514f1e26fdc0
ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database

Vinyl Chloride (CAS: 75-01-4)				
	Yes / No / Insufficent data / Borderline / assume yes or no?	**Value**	**Reference**	**Comments**
Is substance persistent, bioaccumulative and toxic?				
Persistence				
Passes ready biodegradation test	No data			
Passes inherent biodegradation test	No data			
If answer to either question is YES, substance is not persistent				
If answer to both questions is NO, additional data on half life is required				
Half life marine water ≥ 60 days	No data			
Half life fresh or estuarine water ≥ 40 days	Yes	60days	SIDS (2001)	Limited data was available on the degradation of vinyl chloride in water. A half life of 60days was reported in a soil-water microcosm study. However volatilisation was noted to be the main removal process and it was reported that vinyl chloride could persist for up to a year where volatilisation could not occur.
Half life marine sediment ≥ 180 days	No data			
Half life fresh or estuarine sediment ≥ 120 days	No data			
Half life in soil ≥ 120 days	No data			
If answer to any question is YES, substance is persistent				
If answer to all questions is NO, substance is not persistent				
Is sufficient data available? (if not assume substance is persistent)				
Is substance persistent?	**Yes**			
Bioaccumulation				
Bioconcentration factor (BCF) for aquatic species (wet weight) ≥ 2000	No	5.1	SIDS (2001)	This is an estimated value for fish based on the Log Kow
Does field data show evidence for biomagnification?	No data located			
If answer to either question is YES, substance is bioaccumulative				
If no BCF data, is log Kow ≥ 4.5?	No	1.58	SIDS (2001)	
If answer is YES, substance is bioaccumulative				
Does the weight of evidence from the following criteria indicate bioaccumulation unlikely?				
Substance is chronically non-toxic in mammals				
Molecular size ≥ 4.3nm				
Molecular weight ≥ 1100g/mol				
Octanol solubility ≤ 0.002mmol/l				
If weight of evidence indicates bioaccumulation unlikely (i.e. YES answers) substance is not bioaccumulative				
If weight of evidence indicates bioaccumulation a possibility (i.e. NO answers), BCF data should be obtained				
Is sufficient data available? (if not assume substance bioaccumulates)	Yes			
Is substance bioaccumulative?	**No**			**Limited data is available on bioaccumulation with no experimental BCF values located however based on the data available indicates it does not meet the criteria for bioaccumulation.**
Toxicity				
Is the lowest chronic NOEC for freshwater or marine organisms ≤ 0.01mg/l	No data			No chronic data available. The acute data available indicates low acute toxicity with data for algae, invertebrates and fish reported at concentrations >100mg/l (SIDS, IUCLID)
Is there substantial evidence of long term toxicity (STOT RE1 or STOT RE2)	No		ECHA C&L database	Harmonised EU C&L classification
Is substance carcinogenic (Carc 1A,1B), mutagenic (Muta 1A, 1B) or toxic for reproduction (Repr 1A, 1B, 2)	Yes	Carc 1A	ECHA C&L database	Harmonised EU C&L classification
If answer to any question is YES, substance is toxic				
If answer to all questions is NO, substance is not toxic				
Is sufficient data available? (if not assume substance is toxic)	Yes			
Is substance toxic?	**Yes**			**Based on Carc 1A**
IS SUBSTANCE PERSISTENT, BIOACCUMULATIVE AND TOXIC?	**No**			**Does not meet criteria for B**
Does substance pose an equivalent level of concern?				
Very persistent and very bioaccumulative?				
Half life in marine, fresh or estuarine water ≥ 60 days	Yes	60days	SIDS (2001)	Limited data was available on the degradation of vinyl chloride in water. A half life of 60days was reported in a soil-water microcosm study. However volatilisation was noted to be the main removal process and it was reported that vinyl chloride could persist for up to a year where volatilisation could not occur.
Half life in marine, fresh or estuarine sediment ≥ 180 days				
Half life in soil ≥ 180 days				
If answer to any question is YES, substance is very persistent				
Is bioconcentration factor ≥ 5000	No	5.1	SIDS (2001)	This is an estimated value for fish based on the Log Kow
If answer is yes, substance is very bioaccumulative				
Is substance very persistent and very bioaccumulative?	**No**			**Does not meet criteria for bioaccumulation**
Does substance pose a specific risk to groundwater?				
Does groundwater monitoring data show half life in groundwater ≥ 1 year	Not assessed			
Do ≥ 5% of groundwater samples show levels of the substance greater than the LOQ?	Not assessed			
Do ≥ 15% of sites have at least one sample where the substance is detected above the LOQ?	Not assessed			
If answer to any question is YES, substance is persistent in groundwater				
Is substance persistent in groundwater?				
If substance is persistent in groundwater, bioaccumulative AND toxic, substance is hazardous				
Does substance pose a specific risk to groundwater?	**Not assessed**			
Is substance very toxic?				
Is substance mutagenic (Muta 1A, 1B,2) or have no determinable threshold for adverse effects on human health	No		ECHA C&L database/ WHO (2004)	Harmonised C&L classification. It has not been classified as Muta 1A, 1B or 2 but the World Health Organisation (WHO) noted when deriving a threshold for vinyl chloride in drinking water that exposure should be avoided as far as practical and should be kept as low as technically feasible due to its carcinogenic properties.
If answer to any question is YES, substance is very toxic and hazardous				
Is sufficient data available? (if not assume substance is very toxic)	Yes			
Is substance very toxic?	**Yes**			**WHO have noted in deriving their drinking water standard that exposure to vinyl chloride should be avoided as far as practical and should be kept as low as technically feasible due to the carcinogenic properties. Therefore determined as Hazardous as Very Toxic due to the fact no determinable threshold can be derived.**
Is substance hazardous to groundwater?				
Is substance hazardous, if so, state on what basis	**Yes**			**WHO have noted in deriving their drinking water standard that exposure to vinyl chloride should be avoided as far as practical and should be kept as low as technically feasible due to its carcinogenic properties. Therefore determined as Hazardous as Very Toxic due to the fact no determinable threshold can be derived.**
Does substance have breakdown products of concern?	**No**			

REFERENCES

SIDS (2001)
WHO (2004) http://www.who.int/water_sanitation_health/dwq/chemicals/vinylchloride.pdf
ECHA C&L database http://echa.europa.eu/information-on-chemicals/cl-inventory-database