

TITLE: Evaluation and Assessment of Persistent, Bioaccumulative, and Toxic Chemicals of Concern (PBTs) in the Voluntary Action Program

DATE EFFECTIVE: March 2009

HISTORY: Update to VA30009.09.002 - Revision was necessary to reflect changes in the rule citations that became effective in August 2014.

KEYWORDS: persistent, bioaccumulative, toxic, PBT, bioaccumulative effects, food chains, food web model, fish consumption in humans

RULE/ AUTHORITY: OAC 3745-300-08(A)(3)(f); 3745-300-08(H)(1)(a)(i); 3745-300-08(H)(2)(b); 3745-300-09(A)(3)(f); 3745-300-09(E)(1); 3745-300-09(F)(1)

QUESTION: How do I determine whether a chemical of concern is persistent, bioaccumulative and toxic (PBT) for Voluntary Actions? How do I know whether the generic numeric standard considers bioaccumulative effects?

ANSWER: OAC 3745-300-08 lists generic standards for sediment and surface water for residential human and ecological receptors. However, a mandatory property specific risk assessment is required when COCs are considered persistent, bioaccumulative, and toxic, and the development of the generic standard, except for sediment reference values for ecological exposures, does not consider bioaccumulative effects.

This TGC discusses what PBTs are and how to determine if generic standards for COCs in soil, sediment or surface water consider these effects in the development of listed values.

Identification of a COC as Persistent, Bioaccumulative, and Toxic

PBT pollutants are chemicals that are toxic, do not break down chemically or break down very slowly in the environment, and bioaccumulate in food chains. Persistent, bioaccumulative and toxic (PBT) compounds include but are not limited to the following substances; aldrin/dieldrin, chlordane, 1,1'-(2,2,2trichloroethylidene),

bis[4-chlorobenzene] (DDT) and metabolites (DDD+DDE), hexachlorobenzene, hexachloro-butadiene (hexachloro-1,3-

butadiene); hexachlorocyclohexanes (BHCs, alpha-BHC, beta-BHC, delta-BHC); lindane (gamma-hexachlorocyclohexane); alkyl-lead, mercury and its compounds, mirex, photomirex, octachlorostyrene, polychlorinated biphenyls (PCBs), 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD); dioxin; PCDF (furans), 1,2,3,4-tetrachlorobenzene, 1,2,4,5-tetrachlorobenzene; toxaphene, and other chemicals that are reasonably anticipated to bioaccumulate in animal tissues. Chemicals with Log K_{ow} values greater or equal to 3.0 which ecological receptors do not metabolize or metabolize slowly are considered to bioaccumulate in animal tissue.

For COCs not listed above or whose generic values do not include bioaccumulative effects, the potential for a chemical to be a PBT can be assessed using an online risk-screening tool developed by U. S. EPA. This tool predicts a chemical's potential to persist in the environment, bio-concentrate in animals, and be toxic, properties which cause concern for human health and the environment.

Please see: <http://www.epa.gov/oppt/sf/tools/pbtprofiler.htm> for more information.

Basing its assessment on a chemical's structure, the PBT Profiler determines if a chemical is expected to exceed US EPA's PBT criteria. This information can then be used to determine the potential for PBT status for a particular chemical. Please note, however, that the PBT Profiler is a research tool, not a regulatory tool and additional research may be necessary.

Applicable Standards for Sediments to Human Health

Potentially complete pathways to sediments for human exposures must be assessed under two scenarios:

- Direct contact to sediments when the surface water is reasonably anticipated to support recreational activities such as wading, swimming, or boating.
- When the surface water which contains the sediments produces or can produce a consistent supply of edible-sized fish and the chemicals of concern in the sediment are persistent, bioaccumulative and toxic.

For direct contact to sediments, the generic direct-contact sediment standards are the soil standards for residential land use as specified in paragraph (C)(3)(b) of OAC 3745-300-08.

If chemicals of concern in sediment are considered PBTs and the surface water containing the sediments produces or can produce a consistent supply of edible-sized fish, the volunteer must conduct a human health property-specific risk assessment in accordance with OAC 3745-300-09 to evaluate fish consumption.

Applicable Standards for Important Ecological Receptors

To evaluate complete exposure pathways to important ecological resources from environmental media containing chemicals of concern that are persistent, bioaccumulative and toxic, the volunteer must evaluate the environmental media using a food web model in accordance with Ohio EPA's "Guidance for Conducting Ecological Risk Assessments".

Specific Requirements for Ecological Receptors which are Exposed to Contaminated Sediment

OAC 3745-300-08(I)(2) gives a hierarchy of generic standards for exposure of ecological receptors to contaminated sediments. The first source listed for a comparison of the concentration of a chemical in site sediment is the sediment reference values (SRVs). SRVs were developed by Ohio EPA based on sediment sampling at biological reference sites, and represent concentrations present in Ohio at locations least impacted from releases. Because the SRVs are intended to be used as a screening tool for sites that have identified potential sediment contamination in lotic water bodies, they were not developed based on ecotoxicological endpoints or bioaccumulation. If the COCs found in the sediments are at concentrations below the SRV values, additional investigation is not required.

If the chemical of concern is not listed as an SRV, then the concentrations should be compared to the consensus-based threshold effects concentration (TEC) values contained in MacDonald, Ingersoll and Berger's "Development and Evaluation of Consensus-based Sediment Quality Guidelines for Freshwater Ecosystems". The TEC values are based on toxicity alone, no bioaccumulation-based endpoints were used in the development of the values. Therefore, if sediment values are below the TEC for a chemical of concern that is

considered a PBT, then sediments have to be evaluated through a property-specific risk assessment.

If the COC is not listed in the TEC values, then the sediment concentrations are compared to U.S. EPA, Region 5 Ecological Screening Levels (ESLs).

Please see: <http://www.epa.gov/Region5/waste/cars/esl.htm> for the

current list of Region 5 ESLs.

ESLs are based on various endpoints. Some listed values are based on bioaccumulation. The footnotes associated with the values state the source that was used to generate the values. Those that are determined using "wildlife values" consider bioaccumulative effects.

Specific Considerations for Surface Water

Surface water standards define PBTs as "Bioaccumulative chemicals of concern" or "BCCs". The following is an excerpt from OAC 3745-1- 02:

A BCC is any chemical that has the potential to cause adverse effects which, upon entering the surface waters, by itself or as its toxic transformation product, accumulates in aquatic organisms by a human health bioaccumulation factor greater than one thousand, after considering metabolism and other physicochemical properties that might enhance or inhibit bioaccumulation, calculated in accordance with the methodology in rule 3745-1-37 of the Administrative Code.

Chemicals with half-lives of less than eight weeks in the water column, sediment, and biota are not BCCs. The minimum Bioaccumulation Factor (BAF) information needed to define an organic chemical as a BCC is either a field-measured BAF or a BAF derived using the biota-sediment accumulation factor (BSAF) methodology. The minimum BAF information needed to define an inorganic chemical, including an organometal, as a BCC is either a field-measured BAF or a laboratory measured Bioconcentration Factor (BCF). Bioaccumulative chemicals of concern include, but are not limited to, chlordane, 4,4'-DDD (p,p'-DDD, 4,4'-TDE, p,p'-TDE), 4,4'-DDE (p,p'-DDE), 4,4'-DDT (p,p'-DDT), dieldrin, hexachlorobenzene, hexachlorobutadiene (hexachloro-1,3-butadiene), hexachlorocyclohexanes (BHCs), alpha-hexachlorocyclohexane (alpha-BHC), beta-

hexachlorocyclohexane (beta-BHC), delta-hexachlorocyclohexane (delta-BHC), lindane (gamma-hexachlorocyclohexane, gamma-BHC), mercury, mirex, octachlorostyrene, PCBs (polychlorinated biphenyls), pentachloro-benzene, photomirex, 2,3,7,8-TCDD (dioxin), 1,2,3,4-tetrachloro-benzene, 1,2,4,5-tetrachlorobenzene, and toxaphene.

Wildlife criteria, which include bioaccumulation for the protection of wildlife, have been developed as water quality standards for the Lake Erie basin only. COCs with published wildlife criteria include PCBs, mercury, dioxins and DDT (see 3745-1-33, Table 33-2).

SUMMARY:

PBTs are compounds that are toxic, persistent, and bioaccumulate in the environment. For those generic standards that do not consider PBT effects, the Volunteer must assess bioaccumulation through a property specific risk assessment.

OHIO EPA**CONTACT:**

For any questions concerning this issue, please contact the VAP central office at (614) 644-2924.

REFERENCES:

“Guidance for Conducting Ecological Risk Assessments”, Ohio EPA, 2008: <http://www.epa.ohio.gov/portals/30/rules/RR-031.pdf>

PBT profiler tool, U.S. EPA:

<http://www.epa.gov/oppt/sf/tools/pbtprofiler.htm>

US EPA, Region 5 Ecological Screening Levels:

<http://www.epa.gov/Region5/waste/cars/esl.htm>

Ohio EPA, Division of Surface Water, Water Quality Standards

http://www.epa.ohio.gov/dsw/rules/3745_1.aspx