Toxics Use Reduction Institute Science Advisory Board Meeting Minutes
June 13, 2025
Virtual Zoom Meeting
10:00 AM

Members Present: Robin Dodson (Chair), Rich Gurney (Vice Chair), Heather Lynch, Christy Foran, Denise Kmetzo, Ryan Bouldin, Alicia Timme-Laragy, Helen Poynton

Program staff present: Heather Tenney (TURI), Karen Thomas (TURI), Hayley Hudson (TURI), Colin Hannahan (TURI), Sandra Baird (MassDEP), John Raschko (OTA), Nicole Moody (DEP)

Others present: Katherine Robertson (MCTA), Carol Holahan (Foley Hoag LLP), Liz Harriman (LCSP), Raza Ali (ACC), Steve Scherrer (Lanxess), Sergei Levchik (consultant to ACC), Owen Jappen (ACC), Dr. Christopher Simpson (Lanxess)

Welcome & Introductions
Please note that this meeting is being conducted remotely as the provisions to allow remote meetings under the Open Meeting Law have been extended to June 30, 2027. Board members and program staff were introduced, and visitors were asked to put their name and affiliation in the chat.

Approve April Meeting Minutes
There was a motion to discuss the April meeting minutes as written, and there was a second. There was a suggested edit on Page 6, in the second paragraph to remove "In summary, if there are toxicity effects" and replace with "There was discussion regarding concern that these chemicals are going to be persistent, bioaccumulative and in the food chain".

There was a motion to approve the minutes as revised and there was a second. A roll call vote was conducted, and the seven members present at that time voted in favor.

Continued Discussion of the Aryl Phosphates Esters Category
TURI presented information on the possible addition of an aryl phosphate esters category to the 'TURA List of Toxic or Hazardous Substances'.

The following five topics were discussed:

1. Graph of number of added carbons vs $LogK_{ow}$
2. Biomonitoring California category 'non-halogenated aromatic phosphates'
3. Acute Aquatic Toxicity
4. ToxCast and EcoTox data
5. Endocrine disruption studies on potential category members

TURI showed a graph of the number of added carbons by group vs LogK_{ow} that includes all 30 potential substances. Tables of data that had been provided prior to the meeting were also added into the chat so that everyone would be able to access and review the data being displayed. Two potential category members were not included in this graph due to them being "ill-defined" on CompTox with no adequate LogK_{ow} data.

Physical and chemical properties were discussed. Members consider the graph and data as a tool to define the group, see potential trends, and understand the range/scope of how these chemicals relate. The graph allows consideration of the different types of added carbon groups and number of added carbons over the range of potential category members. The LogK_{ow} data inform persistence. The higher the LogK_{ow}, the more likely to be persistent, similar to adding more functional groups, which is also essentially increasing molecular weight. RDP (Resorcinol bis-diphenyl phosphate) and BDP (bisphenol A bis(diphenyl phosphate) don't necessarily fit with the concept of this graph in that counting 'added carbons' is not straightforward.

TURI reviewed how Biomonitoring California grouped these chemicals. The Biomonitoring California Research group recommended adding "Non-Halogenated Aromatic Phosphates" to the Biomonitoring California list. They studied 9 members of this category in 2012. All were found to be persistent or very persistent in sediment. The Biomonitoring California Research group looks at structure, function, exposure potential and toxicity in order to define a group. TURI overlayed these chemicals on the original graph of number of added carbons vs LogK_{ow}.

TURI presented the acute aquatic toxicity studies from the mid-80s. TURI added this information for 8 chemicals to the graph for chemicals having acute aquatic toxicity data, chronic aquatic toxicity data, or both.

TURI reviewed the ToxCast Data for the 11 APEs with data, 9 or 10 of the 11 had positive results for the same 24 assays. TURI presented EcoTox data for 15 chemicals (searched for 'mortality outcome' and "LD50, EC50, NOEC, LOEC") because this combination provided the most data for possible comparison. TURI displayed the information on the graph indicating whether the chemicals had ToxCast data, EcoTox data, or both.

TURI summarized the information on the two ill-defined substances (dicresyl phenyl phosphate and di-tert butylphenyl phenyl phosphate) that were not displayed on the graph and the most similar substances that had data. Both of these chemicals show GHS code 410 'very toxic to aquatic life with long lasting effects' in SciFinder according to the "expert curated" source. According to SciFinder, 'expert curated' means an expert in toxicology and GHS studied the public and nonpublic data to determine the most appropriate GHS code for this substance.

Review of the aquatic toxicity data for these chemicals, shows that there are consistent data for chemicals with each of the various added subgroups. The methyl subgroup has the most data. They are toxic to the aquatic environment; they all have similar acute toxicity. The ToxCast data also shows some similar acute toxicity data as they are tested in water-based assays. The holes in the data are scattered through the group which gives confidence that those chemicals are going to act similarly to the other compounds in the category. On the left side of the graph, diphenyl phosphate (DPP) is the substance with the lowest LogK_{ow} and DPP is a metabolic product of TPP (triphenyl phosphate) so it belongs in the category. One the right side of the graph are the two substances with the highest LogK_{ow} and these both have high bioconcentration factors.

The potential endocrine effects, mostly for TPP, were discussed. In the Gao, 2022 study of humans, the concentrations of chemicals and quantities shows a curve for estrogen and progesterone. Another study looks at mice and changes in steroid hormone levels. Reviewing the 12 studies since 2020 collectively shows hormonal effects from these chemicals. Effects are consistent across multiple species. The reproductive studies are notoriously difficult, though they provide supporting information for category members with TPP and DPP being the most studied. However, there are potency differences.

TURI reviewed the information on neurodevelopmental and reproductive effects, 33 studies from the previous 3 meetings plus 32 additional studies. Behavioral changes in rodents and humans, specifically for EDHP (ethylhexyl diphenyl phosphate) and ITPs (isopropyl triphenyl phosphates), are seen, along with cardio developmental changes. The chemicals pass through the blood-brain barrier.

Visitor Comments

There was an opportunity for visitor comments and there were none.

Summary of APEs

TURI made the 'SAB Decision-Making for Listing' criteria available for all to see. Toxicity and persistence (or bioaccumulation) are both needed to recommend listing under the environmental criteria.

The Board formulated the following supplemental statements:

There is aquatic toxicity consistently across the group. Holes in the data are scattered giving more confidence members of the group will act similarly.

Bioaccumulation is moderate to high across the group and increases with molecular weight. Persistence likely increases with Log K_{ow} especially if Log k_{ow} is higher than 4.5 (most members of the group).

There is concern for endocrine disruption, with varying levels of information and potency across the group. Evidence indicates that TPP and DPP interact with steroid hormone receptors.

Altered behavior in rodents and human neurodevelopment effects have been shown in limited studies of some members.

The following motion was made: Recommendation to list aryl phosphate esters due to evidence of aquatic toxicity and bioaccumulation. With additional concerns for persistence, endocrine disruption, or neurodevelopmental effects of some members.

There was a motion to discuss and there was a second, with no additional discussion. There was a roll call vote to approve the motion with eight members in favor and no members opposed.

Next Meeting

We will plan for a September or October meeting.

Handouts

- DRAFT April Meeting Minutes for Board Review
- Aryl Phosphates Literature Matrix for June 2025
- Graphs and Tables for LogKow
- Literature Review Aryl Phosphate Esters
- Physical and Chemical Characteristics
- Chronic Aquatic Toxicity Studies for Aryl Phosphate Esters
- Summaries of Acute Aquatic Toxicity Studies for Aryl Phosphate Esters
- ToxCast APEs 24 Assays

Zoom Meeting Chat

10:05:15 From Owen Jappen to Everyone:
Owen Jappen, American Chemistry Council

10:05:28 From Liz Harriman to Everyone:
Liz Harriman - Lowell Center for Sustainable Production, UMass Lowell

10:05:30 From Raza Ali to Everyone:
Raza Ali, American Chemistry Council

10:06:09 From Katherine Robertson to Everyone:
Katherine Robertson, MCTA

10:07:08 From Carol Holahan to Everyone:
Carol Holahan, Foley Hoag LLP

10:07:45 From Steve Scherrer to Everyone:
Steve Scherrer, LANXESS

10:08:07 From Dr. Christopher Simpson (Lanxess) to Everyone:
Christopher Simpson, Lanxess

10:26:23 From Hayley Hudson to Everyone:
PhysChemical_Characteristics by number of carbons and by subgroup (1).pdf

10:27:56 From Heather Tenney to Everyone:
graph_1_2_ToxCast_EcoTox.pdf

10:42:43 From Hayley Hudson to Everyone:
Acute aquatic tox studies.pdf

10:44:50 From Hayley Hudson to Everyone:
ecotox and toxcast data table.pdf

11:30:04 From Heather Tenney to Everyone:
This resource, called ToxValDB, collects data from 34 unique sources including those from the EPA, DOE, DOD, CDC/ATSDR, FDA, ECHA, EFSA, Health Canada, and the California EPA. The data is largely limited to summary values from individual studies or chemical-level assessments, and is focused on quantitative values such as LOAELs, NOAELs, BMDs, LD50s and RfDs. Data covers both mammalian studies relevant for human health risk assessments as well as ecological studies.

11:38:52 From Heather Lynch to Everyone:
Replying to " This resource, called ToxValDB, collects data fro...":
Thanks, Heather!

12:05:49 From Rich Gurney (Simmons U) to Everyone:
That is a really high bioconcentration factor, is it not?

12:11:18 From Heather Lynch to Everyone:
I have to step away for a couple of minutes.

12:16:55 From Rich Gurney (Simmons U) to Everyone:

Karen, the only other way I have seen them described is “di and triaryl esters of phosphoric acid”

12:21:08 From Christy Foran to Everyone:

Persistence and Bioaccumulation increase with molecular weight. Persistence is classified as X for TPP and will increase with MW. Bioaccumulation is low/uncertainty for TPP and increases with MW.

12:21:56 From Helen Poynton (she/her) to Everyone:

I am looking at the Australia report, there is no reference for the statement of low persistence and bioaccumulation

12:35:04 From Christy Foran to Everyone:

Evidence indicates that TPP and DPP interact with steroid hormone receptors and have the potential to cause endocrine disruption.

12:49:06 From John Raschko, MA OTA to Everyone:

Should it be a recc. to list the group as a category?