Responses to Public Comments
on the
Draft and *Draft Final*
Washington State
Polybrominated Diphenyl Ether (PBDE)
Chemical Action Plan

May 4, 2006

Department of Ecology Publication No. 06-07-014

Department of Health Publication No. 334-092

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Responses to Public Comments
on the
Draft and *Draft Final*
Washington State Polybrominated Diphenyl Ether (PBDE) Chemical Action Plan

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May 2006

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NOTE: Appendixes B and C contain copies of all the original comment letters received. They are very large files (over 500 pages in total), and are therefore in a separate publication available online at http://www.ecy.wa.gov/biblio/0607014b.html

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Introduction

The Washington state departments of Ecology and Health completed and published the *Washington State Polybrominated Diphenyl Ether (PBDE) Chemical Action Plan: Final Plan* in January, 2006. The plan was developed in response to Governor Locke's Executive Order of January 2004 to investigate and recommend options to reduce the threat of PBDEs in the environment. An initial draft version was published in October 2004, an Interim version in December 2004, and the draft Final in December 2005.

The *PBDE Chemical Action Plan (CAP)* was developed through a multi-program, multi-agency effort, with external stakeholders involved at each step. External advisory committees included representatives from such varied interests as business and consumer and environmental protection. In addition, both the initial Draft and Draft Final versions were made available for public comment. (Refer to the timeline on the next page for more detail on the process of developing the *Final PBDE CAP*.)

The purpose of this Response to Comments document is to report on and respond to comments received by the Departments of Ecology (Ecology) and Health (DOH) on both the *Draft PBDE Chemical Action Plan* (October 2004) and the *Draft Final PBDE Chemical Action Plan* (December 2005). Responses were received by letter, fax, email, and orally. (Oral comments were summarized from notes taken by Ecology staff.) The document begins with the most recent comments, on the *Draft Final PBDE CAP*.

The *Draft Final* document was posted on-line from December 1st to 31st, 2005. Comments were received by letter and email. Following the public comment period, Ecology and DOH reviewed the recommendations and made some changes in light of comments received.

The comment period on the first *Draft* was from October 11 through November 9, 2004. Comments were also received during two public forums: one in Seattle on October 19, 2004 and the second in Spokane on October 26, 2004. Ecology received comments from a total of 33 different organizations and several thousand individuals.

All comments received were carefully reviewed and considered. Ecology and DOH appreciate the time and effort each commenter took to review the drafts of the *PBDE Chemical Action Plan*, develop comments, and submit them.

PBDE CAP Development Timeline

2004

January – Gov. Locke issues Executive Order #04-01

2004 Legislative Session – Legislature provides $83,000 in Supplemental Budget solely for development of PBDE CAP

February – staff person hired to write CAP; research begins

March – Internal Ecology/DOH PBDE Technical Committee formed, comprised of members from 6 different Ecology programs and from DOH's Office of Environmental Health Assessments – met bi-weekly

June – External PBDE Advisory Committee formed (met 5 times, through Dec. 2004)

October – Draft PBDE CAP published; public comment period Oct. 11 to Nov. 9; public meetings held in Seattle and Spokane

December – Public comments received and considered (Nov-Dec); Interim PBDE CAP published

2005

2005 Legislative session – Legislature allocated an additional $187,000 to complete alternatives analysis and cost-benefits analysis on Deca-BDE

May – Ecology and DOH began alternatives assessment and cost-benefits analysis

Summer/Fall – Ecology/DOH PBDE Technical Committee met bi-weekly

July – External Deca-Alternatives External Advisory Committee formed (met 3 times, through Nov. 2005)

December – Draft Final PBDE CAP published; public comment period Dec. 1-31.

December – Internal Ecology/DOH End-of-Life Technical Committee formed. External PBDE End-of-Life Advisory Committee formed; the first meeting was held on March 15, 2006.

2006

January – Public comments received and considered. Final PBDE CAP published.

Acknowledgements

A number of people who contributed to the *PBDE CAP* also helped provide responses to comments on the document. Contributors to the Responses to Comments include:

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Acronyms/Glossary

BDE: brominated diphenyl ether
CAP: chemical action plan
DOH: Washington State Department of Health
Ecology: Washington State Department of Ecology
EOL: End-of-life (a term used to describe a product that is no longer of service or no longer serviceable)
EPA: United States Environmental Protection Agency
EU: European Union
L&I: Washington State Department of Labor and Industries
PBDE: polybrominated diphenyl ether
PBT: persistent, bioaccumulative toxin
PCB: polychlorinated biphenyl
REACH: Registration, Evaluation and Authorisation of Chemicals (EU), a draft proposal for addressing chemicals in the EU
RoHS: "Restriction of Certain Hazardous Substances to Electrical and Electronic Equipment," a Directive which lists the substances that are to be phased-out of electrical and electronic equipment by July 1, 2006 (EU)
TSCA: Toxics Substances Control Act (U.S.)
UL: Underwriter's Laboratories (certify fire safety standards for electrical products)

brominate: to combine (a substance) with bromine or a bromine compound.
bromine: a heavy, corrosive reddish-brown, nonmetallic liquid; an element in a family of elements known as halogens.
congener: a member of the same kind, group or class. *In terms of PBDEs:* the PBDE class includes 209 different theoretical form of the PBDE molecule, called congeners. Congeners vary based on the number of bromines (1-10) attached to the two carbon rings and the position of the bromines on the rings.
debromination: the most common degradation process a bromine product undergoes, losing bromine atoms.
halogen: any of a group of the five chemically-related nonmetallic elements including fluorine, chlorine, bromine, iodine, and astatine.
halogenate: to treat or mix with a halogen.
homologue: belonging to or being a series of organic compounds each successive member of which differs from the preceding member by a constant increment. *In terms of PBDEs:* they are groups of molecules that have between one and ten bromine atoms.

Note: As in the *Final CAP*, commercial mixtures are distinguished from homologues by upper and lower case designations. Commercial mixtures will be identified by capitalization of the first letter ("Deca-BDE," "Octa-BDE," and "Penta-BDE"). Lower case first letter designations (mono-, di-, tri-, tetra-, penta-, hexa-, hepta-, octa-, nona-, and deca-BDE) refer to homologues. The terms "BDE-209" and "deca-BDE" are used synonymously. If a sentence starts with "Deca-BDE" and refers to "deca-BDE," it has been notated as "Deca-BDE(209)," so that the reader will understand it refers to the homologue.

Commenters: Draft Final PBDE CAP

1. Bromine Science and Environmental Forum (BSEF)
2. Puget Sound Action Team (PSAT)
3. State Representative Elaine Nekritz (57th District - Illinois - Des Plaines - Cook County)
4. Oregon Physicians for Social Responsibility
5. Tom Muir (Environment Canada, Retired)
6. Katherine Duff
7. National Association of State PIRGs
8. Boeing
9. Environmental Health Strategy Center, Bangor Maine
10. Washington Chapter -- American Academy of Pediatrics
11. Sarah Janssen, M.D., Ph.D.
12. State Representative Karen May (58th District - Illinois - Skokie, Highland Park - Lake County)
13. The Lands Council
14. Washington Toxics Coalition (WTC)
15. Lynn Sainsbury
16. 1,000+ members of the public, signing and/or adding further comments to a basic letter provided by the WA Toxics Coalition
17. Toxic-Free Legacy Coalition, which includes:
    - American Lung Association of Washington
    - Asian Pacific Environmental Exchange
    - Basel Action Network
    - Breast Feeding Coalition of Washington
    - Coalition for Environmentally Safe Schools
    - Citizens for a Healthy Bay
    - Duwamish River Clean-Up Coalition
    - Earth Island Institute Orca Recovery Program
    - Earth Ministry
    - Friends of the Columbia Gorge
    - Healthy Building Network
    - Healthy Mothers, Healthy Babies Coalition of Washington
    - Institute for Children's Environmental Health
    - Institute for Neurotoxicology and Neurological Disorders
    - Kettle Range Conservation Group
    - The Lands Council
    - Lutheran Public Policy Office
    - Newground Social Investment
    - Northwest Environment Watch
    - Nursing Program, University of Washington, Tacoma
    - Oregon Center for Environmental Health
    - People for Puget Sound
    - RE Sources for Sustainable Communities
    - Seattle Alliance for Good Jobs and Housing for Everyone (SAGE)

- Seattle Tilth
- S.H.A.W.L. Society (Sovereignty, Health, Air, Water, Land)
- The Breast Cancer Fund
- Washington Association of Churches
- Washington Citizens for Resource Conservation
- Washington Physicians for Social Responsibility
- Washington Public Interest Research Group (WashPIRG)
- Washington Toxics Coalition

Responses to Public Comments on *Draft Final PBDE CAP*

Ecology and DOH appreciate all the groups and individuals who took the time and effort to review the *Draft Final PBDE Chemical Action Plan* (December 2005), develop comments, and submit them. The comments received represent diverse opinions and ideas on PBDE-related issues.

The responses to comments are organized here thematically: an issue raised by one or more commenters is summarized at the beginning of each section and the commenters identified, and this is followed by a response from Ecology and DOH. Portions of specific letters are quoted as needed for clarity, to provide more context for the response. Certain letters raised unique issues; these are addressed individually. Issues are not presented in any particular order, but are numbered for easy reference.

In the interest of brevity, we have only included those comments to which substantive responses were needed. For example, we received many letters and emails that were strongly supportive of the recommendations in the *Final PBDE CAP*. Rather than list these individually with a response of "Thank you for your comment," we invite the reader to review all of the comments received in their entirety, which appear in Appendix B (under separate cover).

1. Issue: There is not sufficient scientific data to say that Deca-BDE degrades into more toxic forms. (BSEF, Boeing)

One of the most contentious issues surrounding Deca-BDE is its degradation process: the degree to which it degrades, under what conditions and into what forms.

Ecology and DOH did an extensive review of existing technical articles on the subject, including all the comments and supporting documentation submitted by the Bromine Science and Environmental Forum (BSEF). The *Final PBDE CAP* includes a chapter (Chapter IV) and appendix (Appendix D) solely dedicated to scientific studies on Deca-BDE degradation, as well as an appendix of peer-reviewed, scientific studies on Deca-BDE published in reputable journals (Appendix E), all of which were reviewed for the writing of the CAP.

One of the key premises behind Ecology and DOH's recommendation that Deca-BDE be banned is that Deca-BDE, while relatively safe in its original form, breaks down into more toxic forms of PBDEs (including Penta- and Octa-BDE, which manufacturers voluntarily ceased producing due to the chemicals' persistent, bioaccumulative and toxic characteristics). However, several commenters strongly disagree with Ecology and DOH's conclusions. For example, the Bromine Science and Environmental Forum (BSEF) wrote:

> *The Draft Final Plan states as fact that Deca-BDE is "likely to breakdown in the environment to more toxic and bioaccumulative forms of PBDEs," but does so absent clear or even significant scientific evidence of such degradation. In fact, research suggests that while minimal degradation of Deca-BDE can be achieved in certain laboratory situations,*

that level of degradation is minimal and is not significant enough to be producing the levels of other PBDEs being found in the environment.

Response to #1

We do not concur. Ecology and DOH believe the scientific evidence does indicate a significant level of degradation of deca-BDE to lower substituted PBDE congeners. Numerous studies have evaluated the photolytic and biological degradation of deca-BDE and are included in the Chemical Action Plan. For example, Gerecke et al.[1] showed the anaerobic degradation of deca-BDE to two nona-BDEs and six octa-BDEs in sewage sludge. Deca-BDE(209) concentration decreased by 30% over the length of their evaluation with a corresponding increase in the concentration of degradation products. As the authors state, "…our results provide clear evidence that BDE-209 is degradable under anaerobic conditions and that compounds with a higher bioconcentration potential are formed." Other studies evaluating the photodegradation of Deca-BDE provide similar results.

The BSEF letter goes on to state that "in the environment, approximately 97 percent of the Deca-BDE that is found is located in sediments. Anaerobic degradation studies indicate no significant degradation of Deca-BDE to lower congeners in sediments." BSEF concludes that "Deca-BDE does not contribute in any significant way to the levels of Penta-BDE and Octa-BDE in the environment."

Response to #1 (con't)

BSEF states that in the environment, some 97% of the Deca-BDE found is located in sediments. We do not know the source of this data and therefore cannot confirm its accuracy. Ecology and DOH do agree that large amounts of PBDEs are stored in sediments. In addition, a number of studies (e.g. de Boer, 2001 and de Wit, 2000) concluded that the degradation of Deca-BDE in sediments was negligible. However, this does not mean that the PBDEs in sediments are immobile. One likely mechanism for the movement of PBDEs out of the sediments and into areas where degradation is likely (i.e. sunlight or through biological activity) is the uptake of PBDEs in sediment biota. Since such studies have not yet been conducted, we look to studies in soil to assess whether such uptake is likely. The work by Sellstrom et al.[2] identified that PBDEs in biosolids applied to soils are taken up by organisms such as earthworms and enter the food chain. This study, among others, indicates that deposition in soils does not prevent PBDEs from moving through the environment.

And sediments are only one source of exposure to deca-BDE. Scientific studies have documented the presence of deca-BDE in a wide range of media including food, house dust, earthworms, biosolids, particulates suspended in water, automobiles, etc. These avenues of

[1] Gerecke, Andreas C. et al. *Anaerobic Degradation of Decabromodiphenyl Ether,* Environ. Sci. & Technol., 39, 1078-1083, 2005.

[2] Sellstrom, U. et al. *Effect of Sewage-Sludge Application on Concentrations of Higher-Brominated Diphenyl Ethers in Soils and Earthworms,* Environ. Sci. & Technol., 39, 9064-9070, 2005.

exposure have not been evaluated in detail. However, it has been suggested that substantial exposure may come from sources other than sediment. Therefore to discuss only the impact of sediment is misleading, and minimizes the impact that deca-BDE and subsequent degradation products may have upon human health and the environment. Ecology and DOH do agree that sediments are a substantial reservoir for deca-BDE which can be subsequently distributed through the environment by biological processes.

In addition, due to the large amounts of congeners from the Penta- and Octa-BDE commercial mixtures which have been produced and released over the past decades, it is often difficult to obtain a clear picture of deca-BDE degradation in the environment. The presence of these commercial products and their possible degradation may overshadow contributions made by the degradation of deca-BDE and other congeners. Furthermore, most scientific studies have been centered on the congeners found in the commercial mixtures. Only recently have standards for the non-commercial congeners become available and analytical techniques improved sufficiently to allow scientific evaluation of a wider range of PBDEs. Many previous studies have indicated the presence of non-commercial congeners but have been unable to identify the structure of the degradation products which would provide additional information on the degradation process.

Laboratory studies have clearly shown the degradation of deca-BDE to lower-substituted PBDE congeners including those found in the commercial Penta- and Octa-BDE mixtures. For example, Bezares-Cruz et al.[3] conducted a detailed evaluation of the degradation products produced from their experiments. They found deca-BDE degraded to all of the congeners found in the Penta- and Octa-BDE commercial mixtures as well as numerous congeners that they could not identify. Keum and Li[4] in their evaluation of possible methods to remediate PBDE contaminated sites showed debromination of deca-BDE to lower substituted congeners including, but not limited to, those found in the commercial mixtures. Numerous other studies in peer-reviewed journals provided similar results and have been discussed in the CAP.

Based on the information provided in reputable scientific journals, Ecology and DOH believe that PBDE degradation, including deca-BDE, occurs in the environment. These degradation processes produce a wide range of PBDEs including, but not limited to, those found in the Penta- and Octa-BDE commercial mixtures. This includes tetra- and penta-BDEs which have been shown to have a negative impact upon the environment. Ecology and DOH agree that many other degradation products are produced and that the types of congeners produced will vary considerably based upon the processes involved. The lack of knowledge about the toxicity and biological impact of these unknown by-products is a concern.

Ecology and DOH reviewed many, if not all, of the same technical articles included in the European Union Risk Assessment and its two updates, and have continued to monitor scientific progress since the *Interim CAP* was published. While further research is needed, Ecology and DOH believe the following conclusions are appropriate:

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[3] Bezares-Cruz, Juan et al. *Solar Photodecomposition of Decabromodiphenyl Ether: Products and Quantum Yields*, Environ. Sci. & Technol., 38, 4149-4156, 2004.

[4] Keum, Young-Soo and Qing X. Li, *Reductive Debromination of Polybrominated Diphenyl Ethers by Zerovalent Iron*, Environ. Sci. & Technol., 39, 2280-2286, 2005.

1. Deca-BDE undergoes degradation. The most common path in laboratory studies is the debromination of deca-BDE to lower PBDE species. Other degradation products have been found in some studies, including brominated dioxins, phenols and dibenzofurans. The negative impact these degradation products have upon human health and the environment is unquantified, but the abundance of studies that document negative impacts makes this a matter of considerable concern.

2. Debromination of deca-BDE occurs through light exposure (both UV radiation and direct sunlight) and biological activity. These pathways lead to a variety of degradation products.

3. The rate of debromination has been determined in laboratory studies. Further work is needed to determine the debromination rate under environmental conditions. Degradation in the environment likely occurs more slowly than it does in a laboratory, because laboratory studies are done under accelerated conditions (higher temperatures, nutrient concentrations, etc.) This phenomenon is consistent with what occurs to halogenated compounds with similar chemical structure, and is supported by knowledge of standard chemical processes.

4. Deca-BDE will continue to be a source of lower brominated diphenyl ethers and other degradation products for some time.

2. Issue: Data from laboratory studies cannot be extrapolated to real world conditions. There is no discernable connection between alleged deca-BDE degradation products and those found in the environment. (Boeing)

Response to #2

As mentioned above (*Response to #1*), the presence of large amounts of Penta- and Octa-BDE in the environment and their degradation products provide a unique challenge to the collection of meaningful field data related to deca-BDE degradation. In addition, field studies have centered upon the presence of congeners in the commercial mixtures and it is only recently that standards for additional congeners have become available and analytical methods improved sufficiently to allow an evaluation of a wider range of PBDEs. Although field data is valuable, lack of field data is not atypical and does not pose a major challenge to Ecology's and DOH's ability to support the conclusions in the *Final CAP*.

Ecology and DOH decisions are based on standard scientific and regulatory practices which use laboratory studies to provide information on the impact specific chemicals may have upon the environment. For example, toxicity levels are often based upon laboratory studies conducted on animals at doses usually much higher than we experience in the environment. The data from these studies are then extrapolated to relevant human exposure and used as a basis for regulatory and health decisions. Although this extrapolation is not without its technical challenges, it is accepted as the best alternative given the difficulties involved. This practice is currently used in Washington State for the identification and designation of dangerous wastes. Washington's Dangerous Waste Regulations (Ch. 173-303 WAC) requires designation for state-only toxicity (WAC 173-303-100). Waste generators may conduct a book designation of their waste using animal toxicity results based upon laboratory studies. Toxicity information for fish, rat and rabbit (Toxic Category Table in WAC 173-303-100(5)(b)(i)) are entered into the formula identified in -100(5)(b)(ii). The result of this analysis determines if a waste poses sufficient

threat to human health and the environment to be designated as a state-only toxic waste and disposed of in accordance with the dangerous waste regulations. This is only one example where toxicity data obtained in the laboratory is used for regulatory purposes. Numerous other examples exist in state and federal regulations.

The current requirements TSCA in the U.S. (and the draft REACH proposal in the EU) evaluate the impacts of chemicals on biological processes using standardized laboratory tests. Detractors have indicated the difficulty in extrapolating laboratory results to environmental conditions and the challenges posed in using laboratory results in a decision making process. It is not Ecology's and DOH's intent to discuss the larger issues involved with these practices. However, because of the time needed to evaluate chemical impacts in the environment and the severity of the problems if regulatory response to toxicity is delayed, Ecology and DOH have followed standard scientific practice in using laboratory studies to support its findings. In addition, Ecology reviewed information provided by a wide range of sources including both environmental and industrial groups. A great deal of information was provided by both which made the decision making process more complex. However, because of the importance of the issues involved, Ecology and DOH decided to use only papers published in peer-reviewed, reputable scientific journals. Ecology and DOH decided it was necessary that all data considered undergo strict, scientific evaluation before being included in the decision making process. Therefore, although results mentioned in these comments were reviewed, their conclusions were excluded unless the information was presented in the required venues.

Ecology and DOH believe more work is needed to evaluate the fate and transformation of PBDEs in the environment. However, the weight of scientific evidence supports our concerns and recommendations in the CAP.

3. Issue: Deca-BDE is not a PBT, as defined by Ecology's own rule. (BSEF, Boeing)

PBTs are a group of chemicals characterized by their **p**ersistent, **b**ioaccumulative and **t**oxic properties. On February 13, 2006, Chapter 173-333 WAC "Persistent Bioaccumulative Toxins" became effective. It is the first rule of its kind in the country, and will be used to help Ecology set its internal priorities when addressing PBTs. Several commenters felt that Deca-BDE was neither bioaccumulative nor toxic, and therefore should not be treated as a PBT (unlike Penta- or Octa-BDE, upon which there is agreement on this characterization).

Response to #3

Ecology has reviewed the comments on this issue and agrees that deca-BDE does not meet the PBT criteria in the PBT Rule (Chapter 173-333 WAC) as specified in Section 320 (2) of the rule. However, Section 320 (3) of the PBT Rule states:

> ***Degradation products.*** *Ecology will consider both the parent chemical and its degradation products when making decisions on whether a chemical meets the criteria in subsection (2) of this section. If a parent chemical does not meet the criteria in this section but degrades into chemicals that do meet the criteria in subsection (2) of this section, the parent chemical may be considered for inclusion on the PBT list and in the development of a CAP. Alternately, ecology may*

decide not to include the parent chemical on the PBT list, but consider it during the development of a CAP for derivative chemicals.

Ecology believes there is sufficient evidence that deca-BDE degrades in the environment to less-brominated congeners that meet the PBT listing criteria. (See *Response to #1* on deca-BDE degradation, p9-12.)

4. Issue: Although they are all PBDEs, Penta-, Octa- and Deca-BDE are each unique. The CAP treats them as if they were all the same. (BSEF, Boeing)

Response to #4

The CAP is referred to as the *PBDE CAP* because Ecology and DOH were directed by Governor Locke (via Executive Order 04-01) to do a chemical action plan on PBDEs, not three plans addressing Penta-, Octa- and Deca-BDE individually. Ecology and DOH believe that we have been clear in differentiating between Penta-BDE, Octa-BDE, and Deca-BDE; we recognize that Penta-, Octa- and Deca-BDE are different commercial mixtures of congeners with differences in toxicity, presence in the environment, uses, and commercial applications. We also recognize that congeners associated with Penta- and Octa-BDE have been sampled for in the environment and studied in greater detail than those associated with Deca-BDE (primarily BDE-209). We acknowledge that Penta- and Octa-BDE are known to bioaccumulate and persist to a much higher degree than Deca-BDE.

Ecology and DOH agree that that Deca-BDE is not a PBT in terms of meeting the "P", "B", and "T" criteria as specified in Section 320 (2) of the recently adopted PBT Rule (Chapter 173-333 WAC), and as such, based on Deca-BDE's chemical properties, is not a persistent bioaccumulative toxin (PBT). However, as discussed above (*Response to #3*), Deca-BDE meets the criteria of Section 320 (3) of the PBT Rule regarding degradation products.

5. Issue: Banning Deca-BDE will jeopardize fire safety. Manufacturers may be pushed into using either less safe or effective alternatives, or may stop using flame retardants entirely. (BSEF, Boeing)

Response to #5

There is no question that the flame retardants used in many everyday products save lives. Therefore, throughout the process of developing options to reduce the risks of PBDEs, Ecology and DOH first considered fire safety, then began to look for less toxic fire retardant chemicals.

DOH conducted an extensive survey of the available literature to determine if safer, effective alternatives to Deca-BDE exist for use in electronic enclosures. It is important to note that "safer" relates to impacts on human health and the environment, not the ability of the alternative to work as a flame retardant. **The alternatives assessment considered only those chemicals already proven, and marketed by their manufacturers, to meet fire protection standards.**

A variety of flame retardants currently being used are as effective as Deca-BDE at preventing or slowing the rate of fires. Many companies have already switched to these chemicals. A number of these alternatives are produced and marketed as alternatives to Deca-BDE by the makers of Deca-BDE themselves. However, some of these flame retardants may be more or as toxic as Deca-BDE. Ecology and DOH are recommending a ban on Deca-BDE, but it is contingent upon finding safer, effective, affordable alternatives or upon additional evidence of Deca-BDE harm. It is important that Ecology and DOH do not create a policy that would end up driving manufacturers to less safe alternatives.

The recommendations in the CAP will not cause any decrease in fire safety; this is assured because Ecology and DOH do not recommend that Deca-BDE is banned until a safe and equally fire protective alternative is available. The Washington State Patrol - Office of the State Fire Marshal supports the recommendations in the CAP.

Deca-BDE is often the preferred flame retardant for high impact polystyrene (HIPS), the type of plastic most commonly used in the U. S. for TVs. Underwriters Laboratories (UL) have developed a series of tests to rate the relative flame retardants. The combination of HIPS and Deca-BDE achieves the highest fire safety rating (UL 94 V-0) from UL. TV manufacturers choose to meet the highest fire safety rating, even though there is no federal requirement to use flame retardants in electronic products such as TVs.

The recommendation in the PBDE CAP reads "The Washington State Legislature should ban Deca-BDE provided that safer, effective, affordable alternatives are found or upon additional evidence of Deca-BDE harm." Under this recommendation, electronic/television manufacturers would have a number of options, both now and in the future.

6. Issue: Ecology and DOH do not have enough scientific data to ban Deca-BDE. (BSEF, Boeing)

Response to #6

We know that deca-BDE is used in certain types of computer and TV housings, and some other consumer products, and we know that PBDEs are found in human breast milk in higher amounts in the U.S. than those found in Europe. We know that deca-BDE is found in house/building dust, and has been found in vertebrates including food fish, from which humans acquire it. We also know that deca-BDE breaks down into more toxic congeners. While we do not have sufficient knowledge at this time about the toxicity of potential alternatives to deca-BDE to safely recommend them as a substitute, we think that deca-BDE should to be banned when information about alternate safe flame retardants becomes available. Our experience with other halogenated compounds has shown us that treatment of health outcomes, and efforts to remove them from the environment, are more costly than preventing their entry into the environment in the first place. (See also *Response to #1,* p9-12.)

7. Issue: Ecology and DOH have been up-front about the fact that they need to continue studying and researching Deca-BDE, to gather more definitive data. How can they make determinations of Deca-BDE's harm with their current level of data? (BSEF, Boeing)

For example, Boeing wrote that it is *"presumptuous that the Department staff can in turn make claims of harm to the public based on information they admit is insufficient and they do not fully comprehend . . . [Ecology and DOH are putting forth] presumption[s that] exceed available science."*

Response to #7

While we acknowledge that further scientific data is needed, we believe we have sufficient information to promote preventative actions and to implement precautions. The foundation of public health is prevention. Current research indicates that PBDEs are potentially harmful to the developing infant and that U.S. levels are increasing. An analysis of recent U.S. PBDE human tissue data suggests that people with the highest PBDE tissue levels are already very near to toxic effect levels calculated from animal studies. Chapter III of the *PBDE CAP* reviews the many published studies on PBDE exposure and toxicity. Ongoing and future studies will elucidate specific exposure pathways and populations of highest risk. It is important to consider that PBDEs belong to a group of persistent, neurodevelopmental toxicants, as do methylmercury and PCBs, that can affect infants and children. Infants and children appear to be most highly exposed to PBDEs in utero and through ingestion of breast milk and household dusts. Ecology and DOH will continue to monitor the scientific literature and other reports that address and quantify potential risks from PBDE exposures.

8. Issue: While there is limited information on alternatives to Deca-BDE, there is lots of data on Deca-BDE. (BSEF)

BSEF wrote:

> *Given the fact that Deca-BDE is clearly the most studied and analyzed flame retardant in history, brominated or not, it is hard to understand how or why DOE and DOH arrived at their conclusions and recommendations regarding Deca-BDE. . . . The Draft Final Plan states that "there is a general lack of toxicity and other testing information on many of the alternatives [to Deca-BDE]." This is correct, as we had advised DOE and DOH throughout the process, but the statement fails to note that, in the alternative, there is a significant body of knowledge available on the toxicity of Deca-BDE and that Deca-BDE has a generally favorable toxicity profile.*

Response to #8

Throughout the process of developing the *PBDE CAP*, we often heard the comment that there is a lot of data on Deca-BDE, as a point in favor of its continued use. Ecology and DOH are not clear on what conclusion one is led to by the fact that there is abundant data, in and of itself. We have a lot of data, which is why we're concerned. Quantity of data, in and of itself, bears no relation to whether a chemical is toxic, safe to use, and so on. As to the comment that the body

of knowledge leads to the conclusion that Deca-BDE has a generally favorable toxicity profile, we do not agree with this conclusion because of its degradation products. Degradation is discussed in *Response to #1,* p9-12.

9. Issue: No state or jurisdiction anywhere in the world has taken action against the commercial use of Deca-BDE – not one. (BSEF)

Response to #9

We disagree. Switzerland has issued a ban on electrical products containing more than 0.1% Deca-BDE that becomes effective in July, 2007. Norway has notified the World Trade Organization of its intent to ban Deca-BDE. Deca-BDE is very much on the worldwide radar screen.

Although Deca-BDE is currently exempt from the European Union (EU)'s RoHS directive ban, the EU did not go so far as to say that Deca-BDE use was without risk. In March 2005, the Scientific Committee on Health and Environmental Risks (SCHER), a committee of physicians and professors who serve an advisory role to the European Commission, reviewed the risk assessment for Deca-BDE (May 2004) completed by the U.K. The SCHER disagreed with the recommendation that risk reduction measures on Deca-BDE are not currently necessary. The May 2004 Risk Assessment itself discussed the need for further study of Deca-BDE, particularly the debromination of Deca-BDE to lower PBDE congeners which it cites as of "high concern" and notes that, "many of these substances [lower PBDE congeners] are considered to be persistent, bioaccumulative, and toxic (PBT) or very persistent and very bioaccumulative (vPvB)."[5]

The exemption of Deca-BDE will remain in effect for 5 years, although it can be "unexempted" on the basis of a proposal by the Commission to be adopted by the Council of Ministers. Because of the uncertainty surrounding Deca-BDE, the EU will continue to review new data and studies on Deca-BDE and the Commission may propose an outright ban or specific use restrictions which may include the RoHS exemption in the future.

The decision to exempt Deca-BDE was not without controversy. The Danish government and the European Parliament have announced intentions to challenge the European Commission regarding the Deca-BDE exemption from the RoHS directive.

Closer to home, 8 U.S. states have banned Penta- and Octa-BDE as of this writing. Each of these states has indicated ongoing concern about the risks posed by Deca-BDE and its breakdown products. At least one state has introduced legislation which would ban the sale of Deca-BDE containing products as soon as a safer alternative is identified.

[5] European Commission Joint Research Center, 2005. Addendum to the May 2004 Environmental Risk Assessment Report for Decabromodiphenyl Ether: Draft 2005, p41.

10. Issue: The EU Deca-BDE risk assessment was essentially overlooked in Ecology and DOH's research and decision-making. (BSEF)

BSEF wrote:

> *The Draft Final Plan essentially dismisses as inconsequential the conclusions of the comprehensive European Union Deca-BDE risk assessment . . . and implies that Deca-BDE is under continuous scrutiny in the EU and that its exemption from further regulation could be reversed at any moment . . . Deca-BDE has not been singled out for special treatment.*

Response to #10

To the contrary, we reviewed the Deca-BDE risk assessment very carefully; however we do not agree that the conclusion of the risk assessment -- that further risk reduction measures are not currently necessary for Deca-BDE -- implies that Deca-BDE is therefore safe. And since Risk = Dose x Exposure, and the exposure rate in the U.S. is much higher than that in Europe, we do not agree that the EU conclusion is appropriate for the U.S.

And, as is discussed in *Response to #9,* we are far from alone in disagreeing with the conclusions of the risk assessment. In and around Europe there has been dissention, including that of SCHER, a committee of physicians and professors who serve an advisory role to the European Commission.

Both the *Draft Final* and the *Final CAP* state the conclusions of the European Union Risk Assessment and its Updates, as well as the SCHER opinion. Following the comment period, the International Overview portion of the Final CAP was forwarded to Robert Donkers, Environment Counselor at the Delegation of the European Commission to the U.S., who clarified that Deca-BDE is being watched closely, although not quarterly[6]. The *Final CAP* has been amended to reflect his comments and edits. All chemicals under exemption are being watched closely; we did not mean to imply that Deca-BDE was singled out, and have tried to correct any places where our language may have indicated otherwise.

11. Issue: Banning Deca-BDE will push manufacturers towards less safe alternatives, and creates an unfair market advantage for flame retardants other than Deca-BDE for which little or no testing data is available. (BSEF)

Response to #11

The term "safe" here can be interpreted with respect to fire safety and/or human health and the environment. In either case, we disagree that the CAP pushes industry toward less safe alternatives. The alternatives analysis examined only those chemicals previously determined to be feasible and effective flame retardants for those applications that currently use Deca-BDE. With respect to these alternatives being "safer" for human health and the environment, DOH and

[6] *Pers. Comm.*, R. Donkers, European Commission, to E. Wallace, 10 January 2006

Ecology concluded that, while promising alternatives existed, data was insufficient to conclude that these chemicals would be better than Deca-BDE. However, the global nature of Deca-BDE distribution, its ability to break down into more bioaccumulative congeners and its prevalence in the indoor environment is of concern to DOH and Ecology. This concern encouraged us to look at alternatives, many of which are already widely used in the market place (e.g. Apple Computer). DOH and Ecology support the use of alternatives to Deca-DBE provided that safer alternatives are available.

12. Issue: The policy positions in the CAP are damaging to legitimate and significant business interests. (BSEF)

Response to #12

The *Final CAP* recommends that a ban of Deca-BDE should have an effective date that coincides with the identification of a safer, effective and affordable alternative. This approach impels companies, and provides ample time, to transition to alternatives that are less toxic and yet still provide the same level of fire safety protection as Deca-BDE.

Ecology attempted to complete a cost benefit analysis (CBA) of a ban, and while there do appear to be expenses that would likely be born by the manufacturers, we could find no evidence that a ban of Deca-BDE would be damaging to business interests. Unfortunately the many data gaps in the final CBA analysis made it of limited utility to inform our decisions on Deca-BDE, but our efforts did reveal that many companies are already producing PBDE-free products. Many others are in the process of phasing-out PBDEs. They are doing so without jeopardizing fire safety, and are still in business and making a profit, so it has already been demonstrated that companies can be competitively successful producing PBDE-free products. (See Appendix C in the *Final PBDE CAP* for a listing of companies that have phased-out, or are in the process of phasing-out, PBDEs.)

13. Issue: Ecology doesn't know enough to develop incentives/disincentives for the purpose of encouraging manufacturers to develop safer alternatives to Deca-BDE. (BSEF)

Response to #13

Ecology agrees that we cannot develop incentives without significant input from manufacturers. The recommendation in the *Final CAP* was changed to indicate that any such effort would be collaborative. The recommendation now reads:

> *If safer alternatives are not found in a reasonable time, Ecology and DOH should work with stakeholders to develop incentives/disincentives to encourage manufacturers to identify and develop safer alternatives or product design changes that eliminate the need for PBDEs.*

14. Issue: While pursuing a ban on Deca-BDE, implement incentives to manufacturers now. (Puget Sound Action Team)

Response to #14

We considered developing incentives now, however, developing incentives is an expensive and time-consuming process, and we do not have the resources for such an undertaking. Since we believe that a regulatory solution (a ban) is the best way to prevent further release of Deca-BDE, we are continuing to search for safer alternatives to Deca-BDE, which will allow us to recommend that a ban be put in place by the Legislature. However, due to both a lack of access to information to, and a general lack of testing of, alternatives, it may be difficult for Ecology and DOH to identify safer alternatives. Ecology and DOH will continue to monitor other agencies and organizations which may identify safer and feasible alternatives to Deca-BDE.

15. Issue: The entire process of developing the CAP and the resulting policy recommendations is flawed. (BSEF, Boeing)

BSEF wrote:

> *We noted to DOE and DOH in prior filings our concerns that that the Draft Final Plan Rule, with regard to Deca-BDE, would likely contain policy positions that were scientifically insupportable, contrary to state criteria for the classification of chemical substances, dangerous to fire safety and damaging to legitimate and significant business interests. Unfortunately, our concerns have been borne out, and the Draft Final Plan contains each of these elements. As such, we believe the entire process and any final policy that results will be open to question.*

Response to #15

We disagree. We believe our policy positions are:

- scientifically supported (see *Responses to #1, #2, #6, #7)*
- consistent with state criteria for the classification of chemical substances (see *Response to #3)*
- do not compromise fire protection (see *Response to #5),* and
- do not put unnecessary hardship on business *(*see *Response to #12).*

The CAP was developed through a multi-program, multi-agency effort, with external stakeholders involved at each step. External advisory committees included representatives from such varied interests as business and consumer and environmental protection. We also had the document out for public comment twice, once for the initial draft and again for the final draft. The process of developing the CAP was inclusive, and based on peer-reviewed, credible science.

16. Issue: Ecology and DOH are changing the approach to chemical management in Washington state; preconceived notions are now more important than scientific evidence. (Boeing)

Boeing wrote:

> *[The statement in the CAP] that "What we want to avoid is adopting a policy that allows the continued build-up of PBDEs in our bodies and in the environment as we try to resolve the unknowns" points to a preconceived notion of what the staff thinks is appropriate, rather than a scientific analysis of the actual facts and development of risk analysis. This approach is a paradigm shift in the approach to chemical management in Washington State -- a shift neither debated nor authorized by the Washington legislature. It is an approach that is inconsistent with Federal chemical management concepts in existence since the 1970's. It is a shift in which preconceived notions are more important that proper risk analysis and scientific evidence in setting State chemical management policy.*

Response to #16

It is unclear why our statement points to a "preconceived notion." The quoted statement is the result of our conclusions: conclusions which are based on science, supported by some 400 references and supported in the CAP. Claims that Ecology and DOH staff had preconceptions are speculative and unfounded.

The charge that DOH and Ecology have affected a "paradigm shift" in state chemical policy is also difficult to understand. The regulation of chemical manufacture in the U. S. is governed at the federal level. This fact does not preclude government agencies in the State of Washington from making recommendations to their legislature or Governor to protect public health and the environment, as was directed in Executive Order 04-01. Some recommendations provided in this and future CAPs are likely to be "inconsistent" with federal chemical policy where such policy has proven to be inadequate. The inadequacies of federal chemical policy have been laid out by multiple government, academic and non-profit organizations and are discussed in the *Final PBDE CAP* (Chapter VIII, p94 under U.S. Chemical Policy).

17. Issue: Reform of our national chemicals policy is necessary and urgent. (Washington Toxics Coalition)

Response to #17

We agree that federal chemical policy is in need of reform. One of our policy recommendations in the CAP is that Ecology and DOH will actively seek opportunities to work with other states and interested parties to contribute to the national dialogue regarding needed improvement to U.S. chemical policy, with a goal of developing and advocating practical solutions. As a first step, Ecology staff participated on the steering committee of the "Framing a Future Chemicals Policy" forum in April 2005. The forum was hosted by the Lowell Center for Sustainable Production and was the first North American dialogue about sustainable chemicals policy. The

meeting brought together chemical producers, downstream users, representatives of government and non-government organizations, and others for presentations and group discussions on key elements of a more sustainable chemicals policy.

Ecology has dedicated staff time to continue work with a broad range of stakeholders on identifying and implementing elements of a more sustainable chemicals policy.

18. Issue: The ban of penta- and octa-BDE should go farther, and prohibit the import and use of products containing either. (Puget Sound Action Team)

PSAT commented further:

> *This is a significant loophole in the recommendation and given the types of products containing these chemicals – mattresses and furniture – we could see a significant amount of these products continuing to circulate in the waste stream.*

Response to #18

We need to respond by clarifying Ecology's regulatory authority.

First, Ecology does not have the authority to ban either the use of a product or the use of specific chemicals in products. This authority lies with the State Legislature, and a law would need to be enacted by them for this level of authority. Ecology's regulatory authority only applies to wastes, not products. Washington's Dangerous Waste Regulations (Chapter 173-303 WAC) identifies which wastes must be managed as dangerous wastes based upon their chemical content. Once a product is no longer used and becomes waste, it becomes solid waste subject to designation and must be evaluated against the criteria in Ch. 173-303 WAC. Ecology can change the criteria in the regulations through a public comment process. However, it can only regulate the product once it becomes waste and has no authority to identify what chemicals can and cannot be used in products.

In addition, the dangerous waste regulations make a distinction between waste generated in a home and waste generated by a business. Wastes generated at home are exempt from the dangerous waste regulations and may be disposed of in a standard landfill, usually a municipal landfill. Waste generated by a business must be evaluated to determine if there are any dangerous waste constituents. If there are, the waste must be sent to a dangerous waste landfill. If not, the waste may be sent to a municipal landfill. Ecology cannot designate household wastes (that is, a product for private, individual usage) as either a "hazardous" or "dangerous" waste – even if the amount of hazardous substance in the product (i.e. – such as Penta-BDE in foam padding at 30% by weight) would cause the waste product to be identified as a hazardous or dangerous waste outside the household.

Secondly, Ecology does not have the authority to ban the import of a product. This authority lies with the State Legislature, and a law would need to be enacted by them for this level of authority. Most laws passed by the Legislature in this area recognize that bans place a difficult burden on

Washington businesses if they must comply immediately, so most legislation allows for a "phase-in" period, allowing business to deplete their supply or stock of a product over a specified period of time.

19. Issue: Deca-BDE is the most heavily-used PBDE in the U.S. ***(Oregon Physicians for Social Responsibility, OPSR)***

OPSR continues:

> *Approximately 24,500 tons of deca is put into consumer products in the United States each year, four times as much as is used in Europe. This amount is expected to rise nearly 14% per year, primarily due to increased use in residential upholstered furniture and mattresses.*

Response to #19

We agree with your concern about the widespread, and probable increased use of Deca-BDE, particularly in light of the discontinuation of Penta- and Octa-BDE, and the Consumer Product Safety Commission's proposed flame retardant standards rules for mattresses and upholstered furniture.

The figures do sound quite plausible to us, although we have not been able to confirm them through our own research. We would appreciate following up with you as to your sources. The most recent data we have (2002/2003, from the BSEF website) show the following brominated flame retardant usage globally:

Total Market Demand in 2002 and 2003 in Metric Tons (MT)

	2002	2003
Deca-BDE	65,677	56,418
TBBPA	150,603	145,113
HBCD	21,447	21,951
TOTAL	237,727	223,482

This table suggests that TBBPA (Tetrabromobisphenol A) has been likely more widely used than Deca-BDE as a brominated flame retardant. This may or may not be true for the U.S. alone.

Please note that TBBPA and HBCD (Hexabromocyclododecane) are both listed as PBTs in Washington State's recently enacted PBT Regulation (Chapter 173-333 WAC).

20. Issue: Do not ban Deca-BDE now but continue to evaluate alternatives to Deca-BDE through an independent science advisory board (SAB). (Boeing)

Boeing advises:

> *The Department is encouraged to request funding for an independent and impartial science advisory board (SAB) to evaluate the current and future state of science on PBDEs . . . [The SAB] will report back to the Department and legislature with a majority and minority opinion. Thus a scientifically based, unbiased and politically neutral statement of facts can be delivered to policy makers in the legislature for action, if needed.*

Response to #20

The idea of a Science Advisory Board as an arbiter of science is not new. However, we do not believe it is warranted in this case. DOH and Ecology reviewed some 400 reports and studies, consulted with experts in the field and convened two very knowledgeable Advisory Committees to help us evaluate the state of the science. The Advisory Committees had representatives from a wide range of interests including the Bromine Science and Environmental Forum (BSEF). BSEF submitted several CDs containing some 25 reports which were included in our review. Our assessment was objective, and consistent with our respective missions of preventing harm to our citizens and to the environment.

Ecology and DOH believe that an objective assessment of the available science was completed.

21. Issue: Further research is needed on the potential environmental impacts of PBDEs on the marine environment, specifically in Puget Sound. (Puget Sound Action Team)

Response to #21

We are very aware of, and concerned about, the impact of PBDEs on the marine environment. The Puget Sound Ambient Monitoring Program (PSAMP) has been in place since 1998, focusing on water quality, fish and marine bird populations, toxics and contaminants, shellfish, seagrass, nearshore ecosystem and freshwater quality. PBDEs are on their list of analytes, and the Program is currently monitoring for PBDEs in Puget Sound sediments.

22. Issue: There is no evidence of potentially serious health or environmental effects associated with Deca-BDE. The conclusion that there are seems to be extrapolated from studies on PCBs, an approach that is "scientifically unsupportable." (BSEF)

Response to #22

The language describing our concerns about the potential health and environmental consequences of PBDEs have been clarified in the Executive Summary (page viii) of the *Final PBDE CAP*. That revised text reads as follows:

There are potentially serious health and environmental consequences as the amounts of PBDEs increase, such as neurotoxicity (i.e. effects to neurological development from exposures to unborn and newborn infants), leading to impacts on behavior, learning and memory. Other health effects may include bone malformations, reproductive impacts, and liver disorders.

Concerning the extrapolation from PCB studies, the potential human effects associated with PBDEs described in the CAP are based on toxicity and other studies involving PBDEs. The extrapolation of potential human effects using data from studies with PCBs is used only to derive quantitative estimates of health benefits for two health endpoints (neurodevelopment impairments and liver cancer, see pages 70 -71 of the CAP) in the cost benefit chapter (Chapter 6 and Appendix H).

See also *Response to #2*, p12-13, for further response on the issue of extrapolation.

23. Issue: There is no scientific information that children are now (with the discontinuation of Penta- and Octa-BDE) at any increased risk from exposure to Deca-BDE, nor is it clear that PBDE levels will continue to rise at all. (BSEF)

Response to #23

Studies indicate that levels of PBDEs in human tissues are rising in the U.S. population.[7,8] It is unclear how the termination of production of the Penta- and Octa-BDE products will impact these levels. Given that Deca-BDE can break down into Penta- and Octa-BDE-like congeners, continued use of Deca-BDE may well be an ongoing source of these more toxic and bioaccumulative congeners. Future studies will be able to assess the trend of PBDE levels in the U.S. population. For example, the CDC will be including biomonitoring for PBDEs as part of the National Health and Nutritional Examination Survey (NHANES).[9] Analysis for PBDEs will begin with data collected in 2003.

Studies report that there is wide variability in the levels of PBDEs measured in human tissues.[10] When adjusted for body burden levels, people with higher-end exposures may already be close to

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[7] Sjodin, A., et al., 2004. *Retrospective time-trend study of polybrominated diphenyl ether and polychlorinated biphenyl levels in human serum from the United States*. Environmental Health Perspectives 112(6): 654-658.

[8] Schecter, A., et al., 2005. *Polybrominated diphenyl ether flame retardants in the U.S. population: current levels, temporal trends, and comparison with dioxins, dibenzofurans, and polychlorinated biphenyls.* Journal of Occupational and Environmental Medicine 47(3): 199-211.

[9] Information on chemicals nominated and planned for testing under the NHANES program is available at: http://www.cdc.gov/exposurereport/pdf/nominated_chemicals_planned.pdf

[10] Johnson-Restrepo, B. et al., 2005. *Polybrominated diphenyl ethers and polychlorinated biphenyls in human adipose tissue from New York*. Environmental Science and Technology 39(14): 5177-5182.

toxic effects levels observed in animal studies.[11] Any increase in PBDE tissue levels among the U.S. population will likely increase the percent of the population close to toxic effects levels, assuming the shape of the distribution of PBDE levels remains the same.

Currently, there are no data on PBDE tissue levels specifically in children. Estimates of PBDE exposures during gestation and during infancy are based on PBDE levels measured in cord blood and breast milk of mothers and samples of other foods and household dust. Estimates of PBDE exposures indicate that infants and young children are likely to have the highest intake of PBDEs (compared to older age groups) due to exposures in utero and after birth via breast milk and indoor dust.[12,13] Animal toxicity studies indicate that the most sensitive toxic effects result from exposures during development (in utero or shortly after birth) leading to neurobehavioral effects and abnormal changes in reproductive organs. Therefore, we expect that infants and children are among the most highly exposed age-groups and the most susceptible to potential health effects from PBDE exposures.

24. Issue: Human levels of PBDEs are* ALREADY *greater than levels shown to be toxic in animals. (Janssen)

Response to #24

We included a new reference in the *Final CAP* that addresses comments about the level of concern of existing tissue levels in the U.S. Dr. Thomas McDonald addresses this issue in his 2005 paper and concludes that indeed the current margin of safety appears to be low for the most highly exposed people relative to the most sensitive toxic endpoints of developmental effects.[14] However, his assessment is based on several assumptions including the use of biological half lives in animals and humans for extrapolating toxicity levels observed in animals to people. Further research will better determine sensitive toxic effect levels and will hopefully allow us to better assess levels of concern for people. We have also updated the human health section of the CAP to include the recent references noted by this reviewer.

[11] McDonald, T., et al., 2005. *Polybrominated diphenyl ether levels among United States residents: daily intake and risk of harm to the developing brain and reproductive organs*. Integrated Environmental Assessment and Management 1(4): 343-354.
[12] Wilford, B. H., et al., 2005. *Polybrominated diphenyl ethers in indoor dust in Ottawa, Canada: implications for sources and exposure*. Environmental Science and Technology 39(18): 7027-7035.
[13] Jones-Otazo, H. A., et al., 2005. *Is house dust the missing exposure pathway for PBDEs? An analysis of the urban fate and human exposure to PBDEs*. Environmental Science and Technology 39(14): 5121-5130.
[14] McDonald, T., et al., 2005. *Polybrominated diphenylether levels among United States residents: daily intake and risk of harm to the developing brain and reproductive organs*. Integrated Environmental Assessment and Management 1(4): 343-354.

25. Issue: PBDE-99 has been shown to result in male reproductive toxicity. (Janssen)

Response to #25

We have updated the human health section of the CAP to include the recent reference noted by this reviewer.

26. Issue: A recent occupational study of Deca-BDE exposure confirms a significant uptake of BDE-209 and indicate a potential for degradation of BDE-209 to lower brominated BDEs in humans. (Janssen)

Response to #26

We have updated the human health section of the CAP to include the recent reference noted by this reviewer.

27. Issue: RDP* IS *a safer alternative, nationally available and widely used. (Environmental Health Strategy Center)

Response to #27

While existing information on RDP reviewed for the *PBDE Chemical Action Plan* suggests it is a promising alternative with non-persistent and non-bioaccumulative properties, there is insufficient data, including limited data on toxicity from its manufacturer, for allowing Ecology and DOH to endorse this alternative as a safe alternative. Ecology and DOH will continue to collect information on RDP for evaluating it as a possible safe alternative to Deca-BDE. New information obtained by the agencies on RDP will be made available to the public through Ecology's website.

28. Issue: Deca-BDE cannot really be assessed outside a context that includes cumulative effects and total exposure to all PBDEs and related PHAC analogs (at least). (Tom Muir)

Response to #28

We agree that considering deca-BDE by itself in looking at toxicity is not useful, in light of existing body burdens from other congeners that may no longer be produced, but remain in the environment. It is reasonable to consider receptor interactions of other congeners when trying to assess toxicity. It is because there is evidence that deca-BDE degrades into other, more toxic compounds, and that this could add to the existing body burdens and result in toxic outcomes, that we seek to ban deca-BDE when we are assured that the toxicity information about alternative flame retardants allows us to recommend them as safer.

We are aware that our current national policies allow exposure to many chemicals that can not only add to but exacerbate the toxicity of the other. Your paper is of interest to us, and we will consider your methodology in further actions on deca-BDE.

29. Issue: Recognition of chemical injury, including Multiple Chemical Sensitivity (MCS). The bottom line is, the ban is important to the health of our children. What is the cost of not tending to the health of children and giving them a lifetime of impairment? (Katherine Duff)

Response to #29

Thank you for your letter of support regarding PBDEs in Washington and Multiple Chemical Sensitivity. We are very aware of the impact that MCS can have on health and quality of life. A recent National Institute of Environmental Health Sciences symposium considered a new hypothesis called TILT (Toxic-Induced-Loss of Tolerance) which has been put forward by Dr. Claudia Miller. We regard this as a positive turn on the part of a national health institute towards recognizing what has happened to people who experience this, and an effort to work towards treatment.

Our PBT initiative is working towards controlling those chemicals which are not only toxic but have the specific properties of persisting in the environment and the food chain for long periods of time, and biomagnify (that is, increase in concentration as they are passed up the food web in the direction of mammals like ourselves). Many of our other programs work towards controlling toxic substances in the air we breathe, and the water we drink or use for recreation.

Commenters: *Draft PBDE CAP*

Organizations

1. AeA (High-Tech electronics)
2. Aequus Corporation
3. Association of Washington Business (AWB)
4. Boeing
5. Bromine Science and Environmental Forum (BSEF)
6. City of Seattle – Office of Sustainability and Environment
7. City of Tacoma Public Works Department
8. Independent Business Association (IBA)
9. Institute for Children's Environmental Health
10. King County - Local Hazardous Waste Management Program
11. Matsushita Kotobuki Electronics
12. MBA Polymers, Inc.
13. Northwest Biosolids Management Association (NBMA)
14. Northwest Environment Watch (NEW)
15. People for Puget Sound
16 Pierce County Public Works and Utilities – Environmental Services
17. Pierce County Recycling, Composting, and Disposal, LLC dba LRI (LRI)
18. Puget Sound Action Team (PSAT)
19. Seattle Chapter Fellowship of Reconciliation
20. Tacoma-Pierce County Public Health Department (TPCHD)
21. The Breast Cancer Fund
22. Thurston County Public Health and Social Services Department
23. Total Reclaim
24. Toxic Free Legacy Coalition
25. Washington Academy of Family Physicians
26. Washington Association of Churches
27. Washington Citizens for Resource Conservation (WCRC)
28. Washington Physicians for Social Responsibility
29. Washington State Patrol - Office of the State Fire Marshal
30. Washington State Public Health Association
31. Washington Toxics Coalition (WTC)
32. Washington Retail Association
33. Washington Refuse and Recycling Association

Commenters at Public Meetings

Seattle – October 19, 2004

1. Elise Miller
2. Doreen Smith, salesperson at a natural bedding store

3. Nancy Evans, health consultant for breast cancer fund in San Francisco, 14-year breast cancer survivor
4. John Abbots, NW Environmental Watch
5. David Hayworth, Washington Physicians for Social Responsibility
6. Elizabeth Davis, League of Women Voters
7. Jim Mulligan, Earth Ministry
8. Amy Hirsch, law student
9. Matthew Cacho, Healthy Building Network –
10. Tracy Hendershot, health care worker
11. Bobbi Morgan, Bainbridge retired speech language pathologist
12. Jennifer Cropack, Burien, Washington Toxics Coalition, Audubon Society
13. Cindy Chowdry, mother of two
14. Kelly Faye, mother, toxicology student
15. Megan Blankwise,
16. Beth Seltzer, with son
17. Sarah Augustine
18. Eldon Wall
19. Nancy Dickeman, Physicians for Social Responsibility
20. Ivy Sager-Rosenthal, People for Puget Sound
21. Lindsey Datelund, Seattle resident
22. Mary Ann O'Hara, family physician and PBDE Advisory Committee member
23. Laurie Valeriano, Toxics Coalition
24. Sybil Diver, Toxic-Free Legacy
25. John Staltfuss
26. Linda Boyd

Spokane – October 26, 2004

1. Jenny Greenwood, parent –
2. Debbie Boswell, Lands Council, mother of two
3. Michael Abbier
4. Mike Peterseon, Lands Council, 1400 members
5. Linda Greene

Responses to Public Comments on *Draft PBDE CAP*

This section follows the organization of the *Draft PBDE CAP* (October 2004). For each chapter, section and subsection of the CAP, the commenters are identified, the comments received summarized, and responses provided.

In the interest of brevity and to avoid a document that is very repetitive, we applied these general guidelines to inclusion of comments and responses on the *Draft*:

- We will not repeat issues and responses addressed in the Response to Comments on the *Draft Final PBDE CAP*. For example, there has been a great deal of discussion on Deca-BDE's degradation: how much, how long, and into what. This issue is discussed at length on pages 9-12, *Response to #1*; therefore most of the comments received on that issue in connection with the *Draft PBDE CAP* are not repeated here.
- We have not responded to each comment individually; rather we have tried to respond to common issues as much as possible.
- A number of commenters included informational statements: for example, "Deca has been found in the blood and breast milk of humans, liver of gulls in Polar Regions, and in polar bears." This kind of information is certainly appreciated, but does not lend itself to a substantive response; therefore we want to note the receipt of factual information here, with our thanks. Most of the information received does appear in the *Final PBDE CAP*.
- Several reviewers included suggestions to include additional types of data, to improve the CAP. (For example, one commenter said we should have a chart in the human health showing the levels of deca-BDE found in the food chain and people.) These suggestions were generally very good, however, limited time and resources did not allow us to follow up on all of them. These suggestions will be considered as we look at ways to improve future CAPs.

On all sections of *Draft PBDE CAP*, we received many favorable and encouraging comments; since there is usually no substantive response needed, we have not included the majority of them in our summaries of comments below. The reader is encouraged to read through the original letters. Copies of the original letters, emails, faxes and notes from public meetings are in Appendix C (under separate cover).

Chapter I. Introduction

Commenters: AWB, Boeing, City of Seattle, City of Tacoma PWD, LRI, Washington Refuse and Recycling, Thurston County PHSSD, Jim Mulligan

Summary of comments

- A science-based risk assessment, cost-benefit analysis and small business economic impact statement were not completed and are logical and critical first steps in developing a CAP.
- Less burdensome recommendations, and methods to measure whether proposed recommendations will accomplish the chemical action plan's intended goals, were not fully evaluated.
- Ecology and DOH have not had adequate time or resources to work through all the issues related to PBDEs, and should follow actions being taken by the U.S. EPA.
  1) Coordinate this effort with the U.S. EPA as to action necessary, including a gap analysis specific to Washington State.
  2) Washington State should conform to the standards being developed by the EPA for the management of all forms of PBDEs.
  - The EPA is already taking action on Penta- and Octa-BDE, in their development of a Significant New Use Rule (SNUR).
  - The EPA is studying Deca-BDE to determine if any action is warranted, and so far has indicated that no action is necessary. Washington State should take no action other than to monitor on-going research and agency actions.
- The CAP contains a number of statements that could be confusing to the public and policy makers as to whether the statement was speculation, unsubstantiated extrapolation or assumptions not in fact. Examples cited include:
  - "If brominated dioxins and furans were present in substantial quantities, this could be a pathway for release to the environment." [p27] Comment: The word "if" is the essence of speculation. It has no place in a policy document based on scientific analysis.
  - "Butt et al. found indoor levels of PBDEs in Southern Ontario were 1.5 to 20 times greater than outdoor levels on a site-by site basis. They suggest that indoor air may serve as a significant source of PBDEs to outdoor air." [p27] Comment: "suggest" has no place in a document alleged to be filled with facts- it either is, or is to be confirmed (and hence is not).
  - "As reductive debromination has been observed in experiments using water with dissolved humic substances, it must be assumed that this may also occur in the environment. Other factors, not yet explored, may also influence both photolytic degradation rate and products." [p33] Comment: "It must be assumed" -- policy decisions can not be based on Agency staff's assumptions. This statement creates an unfounded concern about degradation products.

Responses

Risk assessments, cost-benefit analyses and alternatives analyses. Given the extensive work completed on risk assessment in the European Union and other governments, as well as the time-intensive and costly nature of risk assessments, Ecology and DOH believe that a separate risk

assessment on PBDEs is not necessary. The agencies will continue to review risk assessments conducted by other bodies as well as peer-reviewed scientific literature on PBDEs. Our ongoing study and research includes keeping current on the activities of other agencies, including the U.S. EPA.

Ecology and DOH agreed that both a cost-benefit analysis (CBA) and an alternatives analysis were warranted. The economic impacts of a ban on Deca-BDE in Washington State were studied by Ecology and included in the *Final PBDE CAP*. The *Final CAP* also includes the extensive alternatives assessment conducted by DOH on the toxicity of alternatives to Deca-BDE for use in electronics, an assessment that is ongoing. Ecology and DOH continue to evaluate the toxicity, persistence and bioaccumulation characteristics of alternatives, since the recommendation to ban Deca-BDE hinges on the finding of a safe, effective, affordable alternative.

One commenter also stated there was a need for a small business economic impact statement (SBEIS); however this is not appropriate for a CAP. An SBEIS is a process associated with rule development. The PBT rule, Ch. 173-333 WAC, does require an analysis of the economic and social impacts associated with implementing a CAP's recommendations. Ecology did conduct a CBA, as noted above, which is described in the *Final PBDE CAP*.

Less burdensome recommendations and performance measures. The CAP was developed through a multi-agency, multi-program process which included external advisory committees and public comment periods. We feel that a wide range of policy options have been included. Ecology is currently in the process of developing performance measures, which is part of the statewide Government Management Accountability and Performance (GMAP) process.

"Confusing" language. Ecology and DOH disagree. Using speculative words such as "if" can open up additional questions that need further scientific investigation and evaluation. Development and analysis of good policy often requires the drafting of difficult questions and scenarios. Raising several options (often options that do not have easy answers) and developing and discussing the pros and cons of each option (even with incomplete information) can result in a dynamic discussion and a careful evaluation of each alternative. Raising questions and following up on possibilities is of value in both scientific and non-scientific analysis.

The word "suggest" is often used in scientific literature as a way to communicate that the data indicate a trend or relationship but is not conclusive.

Ecology and DOH do not agree that we are making unfounded assumptions. We believe the data strongly indicates that Deca-BDE does break down in the environment into other congeners of PBDEs. For the particular study mentioned in this paragraph, the laboratory set-up includes humic substances, sand soil and sediment, which are found in nature. The degradation of Deca-BDE is discussed at length on pages 9-12, *Response to #1*.

Chapter II. PBDEs: Intended Purpose and Applications (5 sections)

Section 1: Identification

Commenters: NBMA, WTC

Summary of comments

- The potential toxic effects of PBDEs are just being understood, there are still lots of data gaps. Ecology and DOH are to be commended for taking on this task. One of the greatest values of the work is to open up the dialogue on what we do and do not know about PBDEs.
- Deca-BDE is currently used in massive quantities. An estimated 49 million pounds were used in the U.S. in 2001 and this use is expected to grow by 2% a year. Approximately 500 million pounds of deca is already in consumer products that are in our homes, offices, schools, or landfills (Hooper, BFR 2004). The amount already in our environment should be included in the report.

Responses

Data gaps and dialogues. Ecology and DOH have been up-front about the fact that there are data gaps in our understanding of PBDEs. As directed by Executive Order 04-01, we continue to investigate the uses, applications, costs, benefits, and impacts of PBDEs at the local, national, and global levels. We recognize that not all of the information is "perfect," and that data gaps remain. However, these are not adequate reasons to delay recommending policy direction to the Washington State Legislature and to national chemical policy-makers, since there is a great deal that we do know. And our knowledge-base is continually expanding.

And we concur that there is great value in an ongoing dialogue about PBDEs and their known and potential public health and environmental impacts. This is one of the reasons that the *Final PBDE CAP* was developed through a multi-program, multi-agency effort, with external advisory committees and opportunities for public comment throughout the process. And the dialogue continues.

Deca-BDE amounts. Our research also indicates that Deca-BDE is used in large quantities throughout the global market. Volume estimates are included in the *Final CAP,* although as noted in the introductory paragraph to this section (page 31 of this document), all data suggested for inclusion is not reflected in the *Final PBDE CAP*, primarily due to limits on time and resources.

Section 2: How PBDEs Work

No comments were received on this section.

Section 3: Purpose of PBDEs
Commenters: AWB, Matsushita Kotobuki Electronics

Comments received on this section concerned maintaining fire safety standards. This issue is discussed in detail in *Response to #5,* p14-15.

Section 4: Manufacturing of PBDEs

No comments were received on this section.

Section 5: PBDE Applications
Commenter: Matsushita Kotobuki Electronics

Summary of comments

- For a manufacturer to make a change from a PBDE to a non-PBDE adds about 15% to the material cost. This can create havoc on companies' bottom line.

Response

Ecology and DOH recognize that electronic and textile product manufacturers face cost and market challenges as they make changes from Deca-BDE to other flame retardant products or overall product designs. Most ban laws passed by the Legislature recognize that bans place a difficult burden on Washington businesses if they must comply immediately, so most legislation allows for a "phase-in" period, allowing business to deplete their supply or stock of a product over a specified period of time. Many major companies have already moved away from PBDEs, demonstrating that this can be done and one can still be competitive in the marketplace.

As part of our Cost Benefits Analysis, we evaluated price increases associated with the use of products without deca-BDE (*Final CAP*, p65). A wide range of values have been reported regarding what the final price increase would be. The Lowell report[15] estimates the materials-based cost shift between 1.5 percent and 2.5 percent of the final product prices for televisions, although it may not fully cover the costs. Personal conversations with four manufacturers of finished products currently making deca-BDE-free products estimated the increase at between 5 and 15 percent.[16] Another company indicated a price increase of less than 0.5%.[17] Ecology finally estimated the cost increase between 5 to 15 percent for the final product (finished products and components of finished products). (See also *Response to #12,* p19.)

[15] Lowell Center for Sustainable Production, 2005. Decabromodiphenylether: an investigation of non-halogen substitutes in electronic enclosures and textile applications. <http://www.sustainableproduction.org/proj.clea.publ.shtml
[16] Private communication; Cathy Carruthers, Ecology, Fall 2005.
[17] Ibid.

Chapter III. Unintended Consequences: PBDEs, Human Health and the Environment (3 sections)

Section 1: PBDEs and Human Health (3 subsections)

1. Subsection: Human Exposure to PBDEs

Commenters: AeA, Aequus Corp., Boeing, NEW, PSAT, WTC, Elise Miller, Nancy Evans, John Abbots, Bobbi Morgan, Cindy Chowdry, Kelly Faye, Beth Seltzer, John Staltfuss, Jenny Greenwood

Summary of comments

- Of the many comments on this section, the majority were strongly in favor of a ban on all PBDEs. (Of 17 commenters, 14 supported a ban.)
- Several commenters felt there was not enough scientific data to support the idea that Deca-BDE breaks down into more toxic forms. This issue is addressed in detail on p 9-12, *Response to #1*.
- The first thing the CAP should say is that PBDEs do not pose a health risk to humans or other organisms. There are concerns if the levels continue to rise. But presently, no health risk has been shown by the ingestion of PBDEs.
- Fish are not the only dietary exposure pathway. The CAP misrepresents the issue by over-emphasizing fish as the primary source of diet exposure. PBDEs are found in shellfish, pork, chicken, cheese, ice cream, eggs and spinach. Yet, while PBDEs have been detected in all these foods, there still has been no impact on humans or other animals containing PBDEs. This message is not found anywhere in the CAP.
- The food supply is contaminated with deca-BDE; this should be further described in the CAP as this may be an important pathway for human exposure to deca-BDE. Report on the findings of the study by Schecter et al. in 2004.

Responses

Current PBDE levels and their potential for harm. As we state in the Executive Summary of the *Final PBDE CAP (p. ix):*

> Levels of total measured PBDEs in human tissues in the U.S. are 10 to 100 times higher than reported for Europe and Japan. While these numbers are significant, it is important to understand that the mere presence of chemicals does not necessarily represent a health risk. Although PBDEs are present in people and many foods, these levels have not yet reached those shown to be toxic in lab animals and do not pose an immediate health threat. If PBDE levels continue to rise, however, real health risks can be expected, particularly for our children. This is especially significant given the existing large volume of PBDEs already in the environment and the possibility of the increasing use of them in products.

Food pathways. The Human Health section is expanded in the *Final PBDE CAP*, to include additional information in this area. We believe it presents a balanced look at different food pathways to the extent that data is available, specifically notes that DOH continues to encourage

people to eat a variety of fish as part of a healthy diet, and acknowledges the need for additional data on PBDEs in a variety of foods. The 2004 Schecter et al. study was carefully reviewed and its results included as part of the Human Health section. Recent studies referred to in the CAP suggest that indoor dust may contribute as much or more to a person's PBDE exposure than food, especially among young children who spend more time on the floor and are more prone to incidental ingestion of dust. Further research is needed to better understand how different people are exposed to PBDEs. There have been no epidemiological studies done to evaluate potential impacts of PBDEs on the health of people. However, levels of PBDEs measured in the blood, fat and breast milk of people in the U.S. indicate that at least those with higher end levels may be at or near effects levels observed in animal studies.

2. Subsection: Toxicity of PBDEs
Commenter: WTC

Summary of comments

- Don't make statements like "the methodology of this study [the Viberg deca-BDE study] has been criticized" [p19] without presenting an analysis of whether and why the criticisms are valid.

Response

In the *Final PBDE CAP*, the reasons that the results of the Viberg study have come under question are included. We agree that such statements should be explained.

3. Subsection: Build Up of PBDEs in the Body
Commenters: Boeing, NEW, WTC

Summary of comments

- The comments overall reflected support two opposing viewpoints: 1) Ecology and DOH do not have enough definitive data to ban Deca-BDE, and 2) studies are finding higher levels of deca-BDE in people than previously expected and there is sufficient data to ban it now.
- Concern over the use of the "precautionary principle:" the challenge these days is that the threats are subtle and can create fear without having a basis in science. Data indicating that Deca-BDE is a hazard to human health is weak at best, studies poorly translated to humans without much more work. Ecology and DOH lose credibility with reasonable people when they take actions that are so clearly outside the rational boundary of the precautionary principle.

Response

While we acknowledge that further scientific data is needed, we believe we have sufficient information to implement precautions. The foundation of public health is prevention. Refer to *Response to #1* (p9-12) on deca-BDE degradation; *Response to #2* (p12-13) on extrapolation from lab studies to humans; *Response to #6* (p15) on sufficient data to ban Deca-BDE, and *Response to #7* (p16) on sufficient information to determine Deca-BDE is harmful.

New studies are coming out on an almost weekly basis; Deca-BDE is very much on the world radar screen. We will continue to monitor and review the available research.

Section 2: Products Containing PBDEs at End-of-Life (9 subsections)

There were a number of comments on the End-of-Life (EOL) section. Since EOL issues are a complicated area of study unto themselves, Ecology and DOH decided to handle the study of EOL separately from the rest of the CAP, rather than delay publishing the *Final PBDE CAP* until EOL options could be thoroughly examined and recommendations could be made. Ecology has, therefore, formed a PBDE End-of-Life Technical Committee, as well as an external Advisory Committee, in order to look at the issues of disposal, recycling and reuse of PBDE-containing products.

The goal of the Technical Committee is to develop advice and recommendations on how we can best manage the proper disposal and recycling of products that contain PBDEs. Even if no new PBDE products were produced or sold, merely dealing with existing products may require programs and other efforts to limit human exposure and prevent the continued release of PBDEs into the environment for decades to come. Possible solutions could mean changes to everything from recycling practices to landfills. The Technical Committee expects to meet through September 2006.

The PBDE End-of-Life Advisory Committee consists of broad representation from business, industry, recycling interest groups, environmental, health and product stewardship advocacy groups and local governments. This committee is also tasked with providing Ecology with advice and recommendations on how we can best manage the proper disposal and recycling of products that contain PBDEs, but from an external perspective.

Most of the comments we received on the *Draft CAP* are best answered once our EOL work has been completed. We have responded to some of the comments here, to the extent possible.

1. Subsection: Introductory paragraphs and figures
Commenters: LRI, TPCHD, WA Refuse and Recycling

Summary of comments

- In the Executive Summary, the statement is made that "the departments of Ecology and Health recommend a strategy that guides the handling and disposal of existing PBDE products and reduces the manufacture and sale of new PBDE products" (p. iii). However, it does not appear that there are any representatives from the solid waste industry actually responsible for the handling and disposal of these materials. Such a representative could provide valuable insight on this matter.
- In the EOL section the statement is made "while pathways for PBDEs from products to the environment is unknown, it is thought that much of the substance is likely released at the time of disposal." Yet in the Executive Summary it is stated "PBDEs have been detected in everything from food to house dust to indoor air, exactly how people are exposed to PBDEs is an area of ongoing study."
- Table 7: source? Do the values include auto fluff? If not, what would be the impact of including that waste stream?

Responses

Industry representation. The solid waste industry is well represented on our current PBDE External EOL Advisory Committee. (For the complete list of members, see Appendix A.)

Pathways. We agree with the first commenter that the *Draft* sounds somewhat contradictory on the subject of pathways. We revised the first sentence of the EOL section to read: "Pathways for PBDEs from products to the environment are largely unknown."

Table 7. The values do not include auto-shredder fluff. The table is part of a report on waste composition analysis for the state of Washington, done in 2003 by an outside consultant for Ecology. It was never published. Regarding the impact of including auto fluff in the waste stream: that is a question that will likely be considered in our current EOL work.

2. Subsection: Electronics Recycling

No comments were received on this section.

3. Subsection: Landfills

Commenters: Aequus Corp., IBA, Pierce County Public Works, LRI, PSAT, TPCHD, Washington Refuse and Recycling Association, BSEF

Summary of comments

- On the one hand, the *Draft* says that using auto fluff as a daily cover is possibly the best waste management practice with regard to PBDEs; and on the other hand, studies are cited that point to air deposition as the main source of PBDEs in the environment. How does one reconcile that auto fluff typically contains 8-30% PBDEs with dumping tons of this substance shredded into the open air? If Ecology moves to ban PBDEs use and production, the substance should be classified as a hazardous waste and treated as such. Landfills should be required to eliminate future and existing PBDEs from their facilities.
- Input from the vehicle recycling industry includes:
  - auto fluff should continue to be used as a cap for landfills;
  - if there are special handling or disposal costs imposed on PBDE-containing materials, the cost should be borne by the manufacturer or society at-large, not imposed on those responsible for disposal. If handling and disposal costs are imposed on vehicle recyclers, it may destroy the industry.
- Regulatory changes that impact the disposal of vehicle components will have a major financial impact on Pierce County. Before making recommendations that could harm Pierce County's very successful abatement program, a full evaluation of PBDE content in "auto fluff" and a full examination of potential exposure pathways (if any) need to be conducted.
- Considering the widespread distribution of PBDEs in the environment, much of it probably through airborne transport, the State should reconsider the practice of allowing auto fluff in landfills.
- The LRI landfill is singled out due to the receipt of auto fluff even though PBDEs are found in so many waste streams and accepted by every landfill.
- Is the LRI landfill the only municipal solid waste landfill that accepts auto fluff?
- The focus needs to be on the beginning of life of these products, not take away current safe disposal options for products that contain these chemicals. It is unfortunate that one fully permitted landfill was singled out as a facility that received these materials, as all fully permitted landfills accept these materials as well.

Responses

Auto fluff. The text on auto fluff was revised for the *Final CAP*, including deletion of the sentence "It is possible that using auto fluff as daily cover is the best waste management practice with regard to PBDEs." The context for where auto fluff is disposed was broadened, so a third paragraph now begins: "Auto fluff, in addition to being generally disposed of in landfills as part of the municipal solid waste stream, is used extensively at the Pierce County Recycling, Composting & Disposal LLC dba LRI Landfill in Tacoma as a daily cover layer over waste."

LRI Landfill. To the best of Ecology and DOH's knowledge, the LRI Landfill in Pierce County is the only landfill in Washington that uses auto fluff as part of its daily cover. There was no intention on our part to "single out" the LRI Landfill.

Referred to EOL Committees. Most of these comments will be considered in the context of the EOL work currently underway. The subject of PBDE exposure pathways, generally, continues to be an area of research.

4. Subsection: Formation of Polybrominated Dioxins and Furans
Commenter: King County

Summary of issue-related comments

- Coordinate PBDE and PBT initiatives for dioxin reduction.

Response

We agree that additional coordination between chlorine-, bromine- or fluorine-ion sources and overall long-term PBT reduction initiatives will be needed.

5. Subsection: Municipal Waste Combustors
Commenter: WCRC

Summary of comments

- Products containing PBDEs should not be incinerated; the CAP should include a recommendation to ban incineration of products containing PBDEs.

Response

Ecology and DOH agree that incineration of PBDE-containing products can lead to releases of (polybrominated) dioxins and furans depending on incinerator conditions (temperature, other feedstock, etc.). However, we are not yet in a position to agree with the commenter's recommendation that incineration of PBDE-containing products should be banned. We believe that further study and policy evaluation of permitted incineration facilities is needed to determine the best disposal options for products containing PBDEs.

6. Subsection: Biosolids and Sewage Sludge
Commenters: Aequus Corp., King County, WTC

Summary of comments

- Ecology is ignoring biosolids and sewage sludge. PBDE testing has found PBDEs in every sample of biosolids and sewage sludge. If Ecology moves to ban PBDEs use and production, biosolids and sewage sludge should be classified as a hazardous waste and treated as such.
- Deca-BDE is found in sewage sludge, which is used extensively in Washington as fertilizer. This may be an important route for PBDEs to get into the environment and food supply. We are particularly concerned about the sewage sludge that may be applied to grazing land.
- Regulations for sewage sludge incineration lack minimum temperature ranges. For dioxin reduction, perhaps minimum temperatures should be considered.

Response

Biosolids and sewage sludge. Biosolids and sewage sludge are discussed in several places in the CAP, including the "Products Containing PBDEs at End-of-Life" section (*Final PBDE CAP*, p33-34), and in the Monitoring and Research policy recommendations (*Final PBDE CAP*, p100-102). Our EOL work includes looking further at biosolids and sewage sludge and PBDE levels, and in particular examining potential environmental pathways of concern.

"Biosolids" cannot be classified as "hazardous waste," although some "sewage sludges" could potentially meet the classification standards. Biosolids and sewage sludge are not interchangeable terms. "Biosolids" refers to treated sewage sludge that meets certain quality criteria such that it can be beneficially used. One of those quality criteria is that the material cannot be classified as hazardous waste. In the applicability section of the state biosolids rule, sewage sludge that qualifies as a hazardous waste is excluded from the rule and therefore cannot be land applied (WAC 173-308-020(3)(b)).

In terms of risk from biosolids applied to agricultural lands, ignoring everything else, it's important to remember that on an annual basis, biosolids are applied to <u>less than 1/10th of 1%</u> of the agricultural land in Washington State. In 2004, we estimated that ~1.4% of agricultural land in the state is potentially approved for biosolids application and that ~0.09% is actually used. (And this is a bit of an overestimate, because the total approved acres used in making the estimate included forest land.)

Minimum temperatures. The suggestion that minimum temperatures be determined for sewage sludge incineration is noted. Sewage sludge incinerator emissions are currently regulated under 40 CFR Part 60, Subpart O and 40 CFR Part 61, Subparts C and E. The federal rules are enforced by the local air agency.

To establish additional controls, the permitting agency could issue a plant-specific RACT (Reasonably Available Control Technology) order under WAC 173-400-114 and RCW

70.94.153. Alternately, Ecology could go through rule making to establish additional statewide requirements for sewage sludge incinerators.

7. Subsection: Other Burn Facilities

No comments were received on this section.

8. Subsection: Episodic Fires

No comments were received on this section.

9. Subsection: Ash Reuse
Commenters: King County

Summary of comments

- Ash reuse may also have potential actions for dioxin reduction which could benefit both PBT and PBDE plans.

Response

Thank you for your comment; we may consider this in the context of our current EOL work. At this point, we are still looking at a product ban as our main risk-reduction tool.

<u>Section 3: PBDEs and the Environment</u> (4 subsections)

1. Subsection: Air
Commenter: WTC

Summary of comments

- Deca-BDE is often the most predominant PBDE in dust. A recent study conducted by Clean Production Action found deca-BDE in every sample of computer dust: this study should be included in the CAP. The Environmental Working Group (EWG) study on dust discussed in the plan found average level of PBDEs in dust from nine homes was more than 4,600 parts per billion (ppb). It should be noted that this level is well above the average in any previous U.S. dust study. In half of the homes EWG sampled, the predominant PBDE present was the type found only in deca-BDE.

Response

The Clean Action Production study was included in the "House dust" section of the *Final PBDE CAP* (p17). The EWG study, as noted, is also included. Thank you for mentioning these studies.

2. Subsection: Sediment

No comments were received on this section.

3. Subsection: Biota
Commenters: WCRC, WTC

Summary of comments

- The *Draft Plan* states, "Results for the latter three watersheds probably represent background for PBDEs in local freshwater fish" [page 29]. Since PBDEs do not exist naturally, what is meant by "background" in this statement?
- Deca-BDE is found at high levels in the environment. Numerous studies show that deca-BDE is the dominant congener in sediments, contributing the largest percentage to overall PBDE levels (Sellstrom, 1999; Sawal, et al, BFR 2004; Khan, et al, BFR 2004; Song, W., et al., 2004, Environmental Science & Technology, Vol 38, Issue 12, pp3286-3293). This should be reflected in the CAP. Given that deca-BDE is the predominant congener in sediment and it has the ability to break down into more bioaccumulative forms, there is great concern that over time these forms could be found in fish and wildlife (and people) in increasing concentrations.

Response

"Background." With regards to the 2000 Ecology analysis of freshwater fish samples from various locations around Washington State [*Draft CAP*, p 29]: the term "background" in this case refers to the point that PBDEs are being detected throughout the environment due to their ubiquitous nature. PBDEs are widespread, and readily detectable in environmental samples and fish, animal, and human tissue samples. The three watersheds mentioned (Douglas Creek, Rock Island Creek and Soleduck River) are drainages located in low population areas, and therefore would be expected to have lower (and more ubiquitous) amounts than watersheds located in more populated areas.

Studies. Ecology and DOH have reviewed the studies mentioned in the comment above; references to each appear in the *Final PBDE CAP*.

4. Subsection: Environmental Fate and Pathways
Commenters: Aequus Corp., WTC

Summary of comments

- More information is needed on exposure pathways. Ecology and DOH are proposing to ban PBDEs to prevent exposure, but what about the PBDEs present in millions of pounds of existing products?
- Deca breaks down into more toxic and bioaccumulative compounds. This is not a new fact, but old facts are being supported by new science. The PBDE plan should clearly state this and specifically cite this paragraph from a study done in 1973 by Dow Chemical Company (Norris, 1973):

  > *The stepwise photoreduction of DBDPO (deca) and OBBP (octa) in xylene leads to the formation of lower brominated diphenyl oxides and biphenyl oxides and biphenyls which may be more stable to UV light than the parent compounds and cause toxicological and environmental problems in their own right.*

  The CAP should include more information on the biological transformation of deca-BDE including: humans (Jakobsson 2003); rats (Morck 2003); anerobic sludge (Gerecke 2004); and, Detroit River fish (Letcher 2003).

Responses

Exposure pathways. Ecology and DOH agree that more information is needed about exposure pathways, and we continue researching this area. A ban will reduce PBDE use, thereby reducing the continued exposure associated with product manufacturing and use. By banning now, we can avoid potentially high costs in the future, both in terms of human health and the health of the environment, as well as cleanup costs. EOL issues are currently being studied.

Deca-BDE degradation. We agree with the concern about deca-BDE degradation, and with the importance of ending deca-BDE use. The Norris study is part of the *Final CAP* in our chapter on the deca-BDE degradation, and is noted as a resource in Appendix E, although the exact quote provided was not included. The sources cited in connection with biological transformation were all reviewed and are also cited in the *Final CAP*.

Chapter IV. PBDEs and the Regulatory Environment (4 sections)

Section 1: Introduction/WA state
Commenters: LRI

- While the draft document does call out the fact that Chapter 173-303-100 pertains to PBDEs [p35], the level of detail is inadequate. This is not an insignificant issue. Please address this issue in more detail and elaborate upon the implications of this designation upon generators and permitted solid waste recyclers and disposal facilities. Also, please

clarify whether or not any portions of either RCW 70.105D or Chapter 173-340 WAC are applicable.

Response

Regarding Washington's Hazardous Waste Cleanup – Model Toxics Control Act. The commenter's request for further detail on the implications of the statement "many products containing PBDEs would probably be considered dangerous waste at end-of-life" is noted. A response at this time is premature: as discussed earlier (p38), we are currently working on End-of-Life issues, and will consider whether a hazardous waste designation is appropriate as a part of that effort. This comment has been forwarded to the EOL Technical Committee for further consideration.

Section 2: Federal Overview

Commenters: Boeing, King County, NEW, TPCHD, WTC

Summary of comments

- Action by Washington State on PBDEs needs to be considered in the context of actions and findings by other government agencies. For example, the National Academy of Sciences (NAS) reviewed the toxicological and exposure data of 16 flame retardants, including Deca-BDE, to assess potential health risk to consumers and the general population resulting from potential exposure from the chemicals in residential furniture. Despite the lack of a complete database, the report concluded that Deca-BDE, along with a number of other flame retardants listed in Table 8, could be used on furniture with minimal risk, even under worst-case assumptions.
- As stated on page 35 of the *Draft CAP*, wastes containing PBDE flame retardants likely designate under Washington's persistent halogenated compound (HOC) regulations. The criteria for HOC persistence was established around thirty years ago. Purchasers didn't know they were buying a product that at the end-of-life required costly hazardous waste management according to state regulations. Regulators with hazardous waste expertise didn't know HOC-laden products were being sold in such volumes. Had the proper knowledge been readily accessible when PBDEs were first being used, the true cost of the purchase could have been known and perhaps market forces would have reduced PBDE use.
- The PBDE story nationally demonstrates the systemic weaknesses of federal requirements for testing toxic chemicals. We [NEW] reiterate the commendation of state agencies for developing the PBDE Action Plan . . . but as long as the manifest deficiencies of the federal system remain in place, the question seems when, not whether, the PBDE story will be replicated in the future with other chemicals.
- Given the systemic weaknesses of federal requirements for testing toxic chemicals, it seems useful for the Action Plan to include a "lessons learned" section with regard to the regulatory framework. The Plan should also address what measures Washington State agencies could establish as an early warning system to prepare for future situations where

other toxic chemicals might break into public attention, unanticipated by federal agencies.

- Ecology/DOH should evaluate and suggest specific regulatory actions that can be taken at the state level to fill the serious gaps in federal policy (specifically with respect to testing and data) which are resulting in significant problems in Washington.

Responses

NAS review of flame retardants. Ecology and DOH have been closely tracking PBDE-related activities locally, nationally and internationally. We reviewed the National Academy of Sciences (NAS) study in connection with the proposed Consumer Product Safety Commission's (CPSC) flammability standards rule for upholstered furniture. We do not, however, agree with their conclusion that Deca-BDE is an acceptable flame retardant option. Neither NAS nor CPSC, in their evaluations of Deca-BDE, accounted for the degradation of Deca-BDE or the more recent data on Deca-BDE in dust and its association with higher estimated exposures among young children. We expressed our concerns about the use of Deca-BDE to meet proposed CPSC standards earlier this year in a letter sent jointly from the directors of Ecology and DOH to the CPSC urging them to remove Deca-BDE from their list of acceptable alternatives.

HOC regulations. The applicability of the HOC designation for PBDEs will be considered as part of our EOL work.

U.S. Chemical Policy. We concur that there are "systemic weaknesses of the current federal regulatory framework for toxic chemicals." This is an area of great concern to us, and one that was particularly apparent as we struggled with our Deca-BDE alternatives assessment. Because so few studies on each of the alternatives have been conducted and because much of the information collected is not readily available, an adequate evaluation of alternatives to Deca-BDE was made difficult. Even basic information about chemical alternatives, such as production volumes and the number of years the chemical has been in commerce were not publicly available. Our recommendation in the *Final PBDE CAP* (in our chapter on Policy Recommendations/U.S. Chemical Policy, p94) is:

> Ecology and DOH will actively seek opportunities to work with other states and interested parties to contribute to the national dialogue regarding needed improvements to U.S. chemical policy, with a goal of developing and advocating practical solutions. As a first step, Ecology participated as a member of the organizing committee for the Stakeholder Summit on Framing a Future Chemicals Policy, organized by the Lowell Center for Sustainable Production, which took place in April 2005.

More recently (March 2006), a member of Ecology working on chemical policy issues had the opportunity to attend the California Chemical Policy Symposium in Oakland, California.

Lessons learned. While we have not formally compiled a list of lessons learned, everything we learn forms the basis for subsequent efforts, and is therefore implicit in our work. For example, two important developments on PBTs are:

- Ecology's *Proposed Strategy to Continually Reduce Persistent, Bioaccumulative Toxins (PBTs) in Washington State.* This strategy is intended to guide the continual reduction of risks to human health and the environment from exposures to PBTs.
- The "PBT rule," Chapter 173-333 WAC. Ecology finalized and adopted a rule in early 2006 that lays out a process to reduce and phase-out PBT uses, releases and exposures in Washington.

The impetuses for developing the *Strategy* and the rule, and our subsequent work in implementing them (including the CAPs for mercury and PBDEs), were based on lessons learned from past chemical problems and the inadequate management of PBTs. Our attention to PBDEs came in part from the lessons we learned from PCBs. With the PBT rule, we have a process in place for dealing with such chemicals.

Regulatory actions at the state level. The *Final PBDE CAP* proposes various regulatory actions, most significantly that the Legislature ban Penta-, Octa- and Deca-BDE. We'll continue to work with other states and the federal government on issues of common concern, including U.S. chemical policy.

Ecology and DOH continue to closely track PBDE-related activities locally, nationally and internationally. See the *Final PBDE CAP* for more detail on federal activities, p75-77.

Section 3: Other States: Overview
Commenter: Boeing

Summary of comments

- Action by Washington State on PBDEs needs to considered in the context of actions and findings by other government agencies. The state of California passed AB 302 in August 2003, prohibiting the use of Penta- and Octa-BDE. AB302 also required further study of Deca-BDE. The report stated that, based on the "likely potential harm to humans posed by Deca-BDE and the known human exposures to this chemical, it does not appear that human exposure to Deca-BDE is occurring at a level that is likely to be unsafe for human health or development." The report concluded that, at this time, it would be premature to add Deca-BDE to the list of banned PBDEs contained in AB 302.181.

Response

We are aware of the California decision on Deca-BDE, and reported this information in the *Final PBDE CAP* (p77-78). However, it is important to note that the report went on to state that, because of inherent problems in extrapolating from rodent studies to human effects and the limited data on human exposure, it was not possible to say that Deca-BDE does not pose a danger to human health. Rather, the data available does not conclusively show that there is a danger to human health at this time. While the potential breakdown of Deca-BDE is mentioned

in the body of the report, potential breakdown products are not referenced in the conclusion or its rationale.[18]

The report recommends that California's Office of Environmental Health Hazard Assessment set a reference dose for Deca-BDE based on the level in human tissue that would represent an unsafe level. It also recommends that the state create a breast milk monitoring program.[19]

The safety of Deca-BDE is being questioned nationally and internationally. A number of other states have either initiated or passed legislation which bans Penta- and Octa-BDE, and provides for further research into Deca-BDE for possible inclusion (this includes Illinois, Maine, Maryland, Michigan, New York, and Oregon).

Ecology and DOH continue to closely track PBDE-related activities locally, nationally and internationally. See the *Final PBDE CAP* for more detail on activities in other states, p77-80.

Section 4: International Overview
Commenter: Boeing

Summary of comments

- Action by Washington State on PBDEs needs to considered in the context of actions and findings by other government agencies. Even the EU, in a somewhat confusing analysis, has determined that there is insufficient information or harm to ban the use of Deca-BDE.

Response

We have closely monitored the activities around PBDEs in the EU, including maintaining close contact with Robert Donkers, Environment Counselor at the Delegation of the European Commission to the U.S. in Washington, D.C. The decision to exempt Deca-BDE was not without controversy. For a detailed response on EU activities, refer to p17-18, *Responses to #9 and #10.*

Ecology and DOH continue to closely track PBDE-related activities locally, nationally and internationally. See the *Final PBDE CAP* for more detail on international activities, p81-87.

[18] Wiley and McCarthy, 2004. *Polybrominated Diphenyl Ethers (PBDEs): Potential Hazards from DecaBDE and Unresolved Issues from AB 302*. California Senate Office of Research.
[19] Ibid.

Chapter V. Alternatives and Emerging Market Changes (2 sections)

Section 1: Alternatives
Commenters: BSEF, WTC

(Note: Since comments were minimal on this chapter, we have not divided them by subsections.)

Summary of comments

- Alternatives to Deca-BDE are not proven, studied, or available. Forcing substitution to less well understood materials may simply create new problems in the future. Given Deca-BDE's low risk profile, the common sense approach is to maintain use while also monitoring additional information on Deca-BDE and other flame retardants. There are at present no completely acceptable substitutes or alternatives for Deca-BDE that:
  - Are available on an industrial or commercial scale.
  - Provide Deca-BDE's flame retardant capabilities in terms of physical and flammability properties.
  - Are a cost-effective substitute or alternative for Deca-BDE.
  - Have been tested as rigorously as Deca-BDE and found to be safe from both an environmental and human health perspective.
- It is very important that fire safety standards are met and that our families, friends, and loved ones are protected. Products do not need to be less safe in order to protect the environment and our health. Companies should not just exchange one bad chemical for another. But companies need to get a clear, strong, message from this PBDE CAP: it is unacceptable to use toxic chemicals that build up in our wildlife, food supply, bodies and breast milk. Because of failures of chemical policy at the federal level, the public cannot be assured that new flame-retardants will be safe. But our state, through this PBDE plan, can send a strong signal to the marketplace about what is acceptable in Washington. This will also make Washington companies more competitive in the global marketplace, since many companies are moving away from toxic chemicals, particularly in light of new, more stringent European regulations on chemicals. Companies can:
  - Redesign products to reduce or avoid chemical flame-retardants.
  - Use naturally flame-resistant materials such as wool and leather, plastics containing sulfur, preceramic polymers and aramide blends (like Kevlar).
  - Use safer flame-retardant chemicals that are not persistent, bioaccumulative and toxic such as: aluminum trihydroxide, ammonium polyphosphate and red phosphorus.

Responses

Deca-BDE alternatives. Ecology and DOH strongly agree that it would be imprudent to push manufacturers into using alternatives to Deca-BDE that have not been well studied, and could potentially be more toxic choices. This is why our recommendation for a ban on Deca-BDE is contingent upon the finding of a safer, effective and affordable alternative. And this is why our alternatives assessment (for replacements to Deca-BDE in electronic enclosures, Chapter V in the *Final CAP*) considered only those chemicals currently marketed and available to work in the same plastics and products as Deca-BDE, while still providing adequate fire protection.

At the time the *Final CAP* was published, we had not found an alternative that we could definitively recommend. This is because we lack adequate toxicity information on alternatives to Deca-BDE -- likely due to the fact that, under current U.S. chemical policies, toxicity studies on these chemicals are not required or not published. Our research into alternatives continues.

Messages. The *Proposed Strategy to Continually Reduce Persistent, Bioaccumulative Toxins (PBTs) in Washington State* was published in December 2000. It set the stage for the Mercury and PBDE CAPs, and the PBT rule (Ch. 173-333 WAC). The rule lays out a process to reduce, and phase-out PBT uses, releases and exposures in Washington. Ecology is currently developing a multiyear schedule for the preparation of future chemical action plans; the commitment for further work on PBTs in place. These efforts, and others not named here, certainly provide a clear messsage that we are serious about protecting the people and environment of Washington, by reducing exposure to persistent, bioaccumulative, toxic chemicals.

Regarding the commenter's suggestions for less/non-toxic options for companies: while these are all good suggestions, such actions are outside the purview of the *Final PBDE CAP*, and Ecology's regulatory authority. Ecology cannot require companies to redesign products, nor can we tell them what materials or chemicals they must use. That authority rests with the State Legislature. The *Final CAP* does include a recommendation (p97) that the state's Department of General Administration should prefer products that do not contain Deca-BDE; such an action could influence the marketplace.

Appendix C of the *Final PBDE CAP* provides information on the many large companies that produce electronics that have phased out or are phasing out PBDEs. Actions taken by the European Union have encouraged a number of electronics manufacturers to use flame retardant products other than Deca-BDE. Ecology and DOH expect research in this area to continue, since many other governments at the state, federal, and international level have the same concerns and are asking the same questions about PBDEs and Deca-BDE in particular.

Section 2: Market Changes (2 subsections)

1. Subsection: Consumer Electronics Manufacturers and Deca-BDE Alternatives
Commenters: Boeing, Matsushita Kotobuki Electronics, WCRC, David Hayworth

Summary of comments

- On page 55 of the *Draft CAP*, the following statement is made:

  In anticipation of the phase-out of Penta-BDE and Octa-BDE, ***it is expected*** *[commenter's emphasis] that manufacturers are moving away from these products and identifying alternatives. In addition, a number of electronics manufacturers have been identified that are phasing out of all PBDEs, including Deca-BDE.*

This kind of statement is confusing to the public and policy makers. Expected by whom? What evidence do we have that the thousands of manufacturers across the world are changing formulations? Was it market forces or better alternatives? What happens if EU does not ban deca-BDE, will manufactures return to this material? What are the net impact of the substitutes on the environment - is the life cycle cost of smelted metal cases greater or less than deca-BDE?

- Phase out all forms of PBDEs. There are alternatives adopted already by about 20 corporations.
- There should be a comprehensive ban on Deca-BDE in all products. However, if Ecology and DOH decide to limit their recommendation on Deca to electronic and electrical equipment and upholstered fabric, the list of covered electronic and electrical products should be the list adopted by the European Union.

Responses

"It is expected. . ." Our intent is certainly not to be confusing; however, it is not possible for anyone to state definitively what force(s) have contributed to manufacturing changes. Ecology and DOH are of the view that the phase-out of Penta- and Octa-BDE in late 2004 has resulted in manufacturers moving away from these products and identifying alternatives.

What we can and do document are the names of companies that have phased out or are phasing out PBDEs. The commenter neglects to include the last two sentences of the paragraph cited, which goes on to say:

> *Specific policies are listed in Appendix C. Electronics manufacturers phasing out of PBDEs in some or all of their products include: Apple, Brother, Daikin, Dell, Ericsson, Hewlett Packard, Masushita, Mitsubishi, NEC, Samsung, Sharp, Sony, ViewSonic, and Xerox. IKEA has also phased out all PBDEs.*[20]

To ask what evidence we have that "thousands of manufacturers across the world are changing formulations" is a misreading of the paragraph; there is no implication that we are talking about thousands of manufacturers. And "evidence" is in the remaining sentences of that paragraph, where we provide names of the many major manufacturers that have phased out, or are phasing out, PBDEs. A more complete picture is captured in Appendix C of the *Final PBDE CAP*. (Appendix C was updated for the *Final CAP*.)

We cannot predict whether the EU exemption of Deca-BDE will result in some manufacturers returning to Deca-BDE: it may or may not. And regarding the impact of possible alternatives on the environment: we have been very clear in our recommendation that a ban of Deca-BDE is contingent upon finding a safer, effective, affordable alternative. We certainly do not want to push manufacturers into using alternatives that may be worse. (See also p18-19, *Response to #11*.)

PBDE ban. The recommendation in the *Final PBDE CAP* calls for a ban on all new products, not any one particular type of product.

[20] M. Bjork, *Banning brominated flame retardants*, BFR 2004.

2. Subsection: Environmentally Preferable Purchasing

No comments were received on this section.

Chapter VI. Policy Recommendations (4 sections)

Section 1: Products Containing PBDEs at End-of-Life

Commenters: Aequus Corp., Boeing, BSEF, City of Seattle, IBA, King County, MBA Polymers, NEW, People for Puget Sound, Pierce County PWU, LRI, TPCHD, Total Reclaim, WCRC, WTC, WA Retail Association, Matthew Cacho, Tracy Hendershot

Summary of comments

- The proposed recommendations on PBDEs have multiple social, safety and economic impacts that will require extensive additional study. For example:
  - Recycling. Two sets of recommendations are needed to differentiate between the impact of the Penta-/Octa-BDE ban and the Deca-BDE ban, since the supply of products with the former will run out in July 2005. The Penta-/Octa-BDE issue will be one of recycling and reuse. Washington needs to carefully craft rules on recycling and new products containing recycled content to maximize environmental benefits.
  - Manufacturing buy-back. All reference to this approach for management of any material, PBDE or otherwise, should be stricken from the CAP pending legislative resolution of the surrounding policy issues.
  - Deca-BDE ban on electronics. The ban as written would cover just about every electrical and electronic item, and would negatively affect average consumers as well as small and large businesses.
- Small businesses have very serious concerns about identifying PBDEs as a "special waste." It is unclear what "special waste" means. It is unclear that there is a statutory basis for such a classification. This recommendation should be removed from the CAP.
- Please clarify whether or not the existing state-only designation pathway (for halogenated organic compounds, Ch. 173-303 WAC) applies to PBDEs, and, if so, whether or not the common products listed in this document would in fact designate as state-only dangerous waste. . . The existence of the current "special waste" clause in Ch. 173-303 WAC would not meaningfully reduce the impact of state-only designation for PBDEs.
- Publication of this *Draft CAP* serves to bring attention to the need for Ecology to review the utility and application of the state-only dangerous waste designation (Ch. 173-303 WAC). Available data indicate that due to PBDEs, many waste streams previously considered "solid waste" are, in fact, state-only dangerous wastes.
- Do products containing PBDEs (at sufficient concentrations) meet the definition of "hazardous substance" as defined for the purposes of the Model Toxics Control Act? If so, is assessment of the "hazardous substances tax" applicable? If so, what are the implications?

- How will the presence of PBDEs in (at least some) electronic wastes impact the Hazardous Waste and Toxics Reduction Program's policy regarding e-waste management, and e-waste recycling, and disposal facilities?
- Manufacturers should be required to fund PBDE monitoring and research activities. The State should also consider the possibility of requiring manufacturers of PBDE-containing products to fund, at least in part, a state-developed plan for the disposal/recycling of PBDE-containing products. Involving manufacturers financially not only allocates end-of-life costs appropriately, but will likely result in a more sustainable system. Although getting manufacturer involvement may be a challenge, perhaps the best way to bring their research and development resources to bear is by having them share the end-of-life costs.
- The end-of-life management section acknowledges that many wastes with PBDEs designate as persistent dangerous waste now. Until new regulations are developed in July 2007, waste management guidance for proper disposal during this interim period is needed. Otherwise, generators may be at risk of knowingly disposing of dangerous waste improperly.
- Restrictions on the use of products with PBDEs will hurt Washington's growing plastics recycling industry and will force used plastics to be disposed of in landfills, incinerated with other waste streams, exported to other countries, or other disposal options. If the use of PBDEs were completely prohibited today, without allowing for small allowances stemming from recycled plastics, it would be virtually impossible to implement cost-effective consumer electronic recycling programs and the legislation would substantially undermine the market for recycled material in durable goods applications. If we can't recycle these plastics, new plastics must be made to meet the needs of manufacturers, which will result in use of much more precious energy, increased greenhouse gas generation and higher costs to manufacturers. We don't think that this is the intent of the legislation.
- If Washington bans the sale of new products containing PBDEs, this represents a defacto ban on the recycling of products such as carpets, mattresses, computers, TVs, and other electronic equipment that contain these fire retardants. The only recourse will be to dispose of these materials in landfills or incinerators. This is in conflict with the current state policy to encourage recycling of these materials.
- We [People for Puget Sound] support the recommendation to examine current disposal and recycling practices and determine how to handle PBDE-containing products at end-of-life. The recommendation should be strengthened by incorporating the following:
  - Move up the timeline (from 2007 to 2005) for completing the investigation of what products contain PBDEs and ensuring proper disposal of these products.
  - Require manufacturers to sort products at end-of-life.
  - Require manufacturers to report whether their products contain PBDEs.
  - Ban the incineration of PBDE-containing products.
- A serious shortcoming of the CAP is that it seems to place more emphasis on end-of-life controls than on research or source control. EOL controls treat the symptoms and not the root problem.
- EOL controls would place a significant burden on solid waste and hazardous waste management systems. While EOL controls would arguably be the simplest to implement at the state level, avoid this "easy" answer.

- Regarding recommendation #3 and the five bulleted items included there (*Draft CAP*, p57):
  - Ch. 173-303 WAC is not the appropriate mechanism to regulate solid wastes that have not been traditionally in the sphere of municipal solid waste.
  - It is impractical to isolate PBDEs and remove them from the waste stream; they are going to be waste somewhere.
  - Current wisdom is that PBDEs are safely contained in mixed municipal solid waste landfills permitted under Ch. 173-351 WAC; nothing in the draft CAP demonstrates otherwise.
- Regarding the fourth bullet under recommendation #3 ("Allowing the disposal of products containing PBDEs in waste disposal facilities where they will be safely contained," *Draft CAP*, p57): the way it is worded could be interpreted to mean that solid waste disposal facilities safely contain PBDEs, which the CAP states is currently unknown. The bullet should be rewritten as "Allowing the disposal of products containing PBDEs in waste disposal if and where it is determined that they will be safely contained."
- The recommendation to examine current disposal and recycling practices and determine reasonable end-of-life procedures that are protective of human health and the environment makes sense. However, the 2007 deadline is too far in the future. Starting immediately, Ecology should obtain information on PBDEs used in Washington State businesses that discharge waste into waters of the state, and also require manufacturers providing products to the state to report the use of PBDEs and other halogenated flame retardants.
- Retailers that sell second-hand goods would be exposed to lawsuits, despite the fact that they would have no way of knowing what products contained PBDEs.

Responses

As discussed in this document in the introduction to Chapter III, section 2, "Products Containing PBDEs at the End-of-Life" (p38), Ecology and DOH are in the process of studying end-of-life issues and developing recommendations. We appreciate the great concern about end-of-life issues shown through the number of comments received specifically on this subject. These comments will be considered in the context of our end-of-life work, scheduled to be completed in the Fall of 2006.

A few specific responses at this time:

Special waste/hazardous waste designations. We will evaluate whether the disposal of PBDE-containing wastes to municipal landfills is sufficiently protective of human health and the environment or if additional steps need to be taken to separate these products from the municipal waste stream. If landfill disposal proves protective, we will determine whether such special designations are appropriate. These evaluations will be conducted as part of our EOL work.

Interim waste management guidance. Providing interim guidance before new regulations are developed in July 2007 is a good suggestion. However, given the time it would take to develop a guidance document and our limited resources, our primary focus will be developing

recommendations via the EOL process. If further waste management guidance is needed, we will look into that when our EOL work is completed.

Plastics recycling. Ecology and DOH are currently in the process of examining whether the recycling of electronics containing Deca-DBE is adequately protective of human health and the environment.

Manufacturer responsibility. In March, 2006, Gov. Gregoire signed the electronic recycling bill (ESSB 6428) into law. This law requires the manufacturers of TVs and computers to establish and pay for programs to collect and recycle these products, effective January 1, 2009. While this law will not impact all PBDE-containing products, it will encompass a large percentage of the types of products currently containing PBDEs.

Regarding requiring manufacturers to fund PBDE monitoring and research activities: this would take legislative action. Some monitoring may be able to be done through our air, hazardous waste etc. permitting processes. Ecology can regulate certain pollutants at the site of Washington facilities. Our regulatory authority, of course, does not extend to manufacturers in other states or parts of the world.

Obtain information on PBDEs being discharged into waters of the state, and require manufacturers to report the use of PBDEs. Resource and regulatory limitations prevent us from following through on these suggestions at this time.

Focus more on source control than on EOL. Ecology and DOH still believe that the best risk-reduction tool for PBDEs is a ban. Stopping the introduction of new PBDE-containing products will reduce continued exposure, and we will thus reduce potentially high costs in the future, both in terms of human health and the health of the environment, as well as cleanup costs. However, we also need to look at EOL issues, to evaluate whether our current practices (disposal, recycling, reuse) are adequately protective.

<u>Section 2: Source Control</u> (2 subsections)

1. Subsection: Penta-BDE and Octa-BDE

Commenters: AWB, City of Seattle, People for Puget Sound, PSAT, The Breast Cancer Fund, WCRC, WTC, Eldon Wall, Mary Ann O'Hara, Elizabeth Davis, Linda Boyd, Boeing

Summary of comments

- A ban on Penta- and Octa-BDE is not needed, since they are no longer being made in the U.S. And the EPA is developing a Significant New Use Rule (SNUR) on Penta- and Octa-BDE which will make it virtually impossible to manufacture or import products containing Penta- or Octa-BDE after January 2005.
- We support the recommendation to ban the manufacture, sale, and use of products containing Penta- and Octa-BDE. However, the timeline for the phase-out should be moved to January 1, 2006. A longer timeline is unnecessary because industry has

voluntarily agreed to stop using Penta- and Octa-BDE by 2005. An effective date of January 1, 2006 would help ensure industry will comply with the voluntary agreement and also synchronize Washington's ban with the bans recently passed in Maine and Hawaii, both of which are effective January 1, 2006.

- Phase out of *all* PBDEs in Washington State and throughout the nation. Don't create a toxic legacy like PCBs.
- Institute a public information campaign, a full-page ad in "The Seattle Times," or a campaign through the schools to inform parents. Can we change the regulations for schools and child cares for PBDEs (i.e. flame retardant materials)? It's hard to find out whether this product or that product contains it. Thank you for your good work.
- Ecology and DOH need to ensure that there is an exemption or waiver process incorporated into any scheme to manage PBDEs. These options need to ensure these products can be used when unique applications are required. For example, the EU recognized this need and granted an interim waiver for use of Penta-BDE in aircraft escape slides.

Responses

The comments were overwhelming in favor of the ban of Penta- and Octa-BDE, which are both known persistent, bioaccumulative toxins, found in increasing concentrations in the environment and in humans. Although they are no longer being manufactured in the U.S., and in most international markets as well, there is currently nothing that would prevent a manufacturer, either domestic or foreign, from reintroducing Penta- and Octa-BDE on the market. (The EPA's proposed SNUR would not prohibit the import of products containing Penta- or Octa-BDE). A ban would also provide a disincentive to manufacturers from reintroducing these products. Manufacturers should feel little or no impact since they have already arranged for alternatives to these chemicals in order to comply with the EU ban and the discontinuation of supplies to the U.S. A ban on the manufacture, distribution, or sale of new products containing Penta- and Octa-BDE would be consistent with similar laws in the European Union, California, Hawaii, Maine, and New York.

Move up effective date of ban. A number of commenters asked that the effective date of the ban be changed from July to January 2006. We appreciate the sense of urgency at instituting a ban and the desire to move the date up. However, establishing a ban is under the purview of the Legislature, and time is needed for that body to deliberate and determine appropriate provisions. (Since the release of the *Final PBDE CAP* was in January 2006, the specific date concerns are no longer relevant.)

Informing the public. One of our recommendations in the *Final PBDE CAP* (p98) is:

> DOH should develop methods and materials for health education about PBDEs. DOH should develop and implement a strategy to communicate with health care providers about PBDEs and provide guidance appropriate for both the general public and health care providers concerning reduction of exposure to contaminants in the environment, including PBDEs. This strategy will include information on the benefits of breastfeeding and the benefits of eating fish as part of a healthy diet.

DOH has already created brochures and a website to educate the public on reducing exposure to PBDEs. The state Department of Labor and Industries has already begun providing information to employees on how to minimize PBDE exposures.

With regard to the request to change regulations for schools and child care facilities: we considered information/educational campaigns and decided that regulatory actions would be the best way to approach PBDEs (a ban on Penta-, Octa- and Deca-BDE). A ban will be most protective when it covers all uses, not just those of a particular sector.

A number of commenters suggested labeling products containing PBDEs; refer to the Response for Section 3, Minimizing Human Exposure, p60-61 of this document.

Waivers/exemptions. We agree with the commenter who said that we need to ensure that there is an exemption or waiver process incorporated in any scheme to manage PBDEs. The recommendation in the *Final PBDE CAP* for a ban on Penta- and Octa-BDE includes this statement: "The ban should include an exemption for products where no alternative for Penta-BDE or Octa-BDE is available."

2. Subsection: Deca-BDE

Commenters: AeA, Aequus Corp., AWB, Boeing, BSEF, City of Seattle, IBA, King County, Matsushita Kotobuki Electronics, NBMA, NEW, People for Puget Sound, PSAT, The Breast Cancer Fund, Thurston County PHSSD, Toxic-Free Legacy Coalition, WA Academy of Family Physicians, WA Association of Churches, WCRC, WA Physician's for Social Responsibility, WA State Patrol, WA State Public Health Association, WTC, WA Retail Association, Jennifer Kropack, Megan Blankwise, Sarah Augustine, Sybil Diver, Debbie Boswell

Summary of comments

- Several commenters were concerned about jeopardizing fire safety; this has been addressed on p14-15, *Response to #5*. One commenter, however, specifically requested that Ecology and DOH conduct a risk and impact analysis and withdraw any recommendations on banning Deca-BDE until that analysis is completed, reviewed and publicly commented on. "The agency's lack of analysis leaves unanswered questions about any increased risks of deaths and injuries in fires, the likelihood of more fires, and the environmental and health effects of combustion products in such fires."
- The Office of the State Fire Marshal is supportive of the recommendations outlined in the CAP, writing: "We believe there will be alternative flame retardant materials that are currently in development and beginning to enter the market place and look forward to continued research and development of these materials. We also recognize the associated health and environmental hazards that exist in the current materials being offered and would like to support a move towards decreasing these risks and hazards. . . . we strive for the same purpose of protecting lives and the environment and support the direction Governor Locke is providing towards reducing the use of these specific flame retardant chemicals."

- Ecology and DOH should not recommend restriction of any kind on Deca-BDE.
- Small businesses are opposed to a Deca-BDE ban. The recommendation is very premature with inadequate analysis of the effects of such a ban and inadequate analysis of the alternatives that could replace Deca-BDE.
- There are concerns about the economic impact of a Washington-only ban on consumers and businesses in our state. Will non-Deca products be more expensive? If Deca-BDE is only banned here, there will be a financial burden on Washington's business community, putting retailers at a serious disadvantage. And what about online retailers? The law only impacts sellers within Washington, increasing the costs of goods in the state, and in turn driving consumers to the internet or to neighboring states to save money. Online sales would still contain Deca-BDE and there would be no way to police these sales.
- While there are some questions regarding the safety of Deca-BDE, we [City of Seattle – Office of Sustainability and Environment] agree that the best solution is to take precautionary measures to reduce the potential for its increased use.
- Stop Deca-BDE at the source. Educating consumers has a role, but there is only so much consumers can do.
- Most commenters were strongly in favor of a ban, but there were two recurring requests:
  - The ban should be on all products, not just new electronics and electrical equipment and upholstered furniture.
  - The ban should be moved up and become effective in 2006.

  There was concern that if only certain types of products were banned, it would allow for "Deca creep:" Deca-BDE use will increase, especially with the phase-out of Penta- and Octa-BDE. Closing all the loopholes was considered preferable. Another comment several reviewers made was that a ban drives innovation. Without a total ban on Deca-BDE there would be no driver in place to push manufacturers to find alternatives. Most commenters felt there was no reason to delay a ban until 2008: for example, the Toxic-Free Legacy Coalition wrote: "added time only means more deca will pollute our homes, wildlife, and our bodies. In addition, the solution will take longer and be more expensive." Many commenters cited the EU timeline, and felt we should be in sync with that. (The *Draft Plan* was, of course, published prior to the Deca-BDE RoHS exemption.)
- [NBMA] agrees with the general approach Ecology has taken with the recommendations contained in the draft chemical action plan. Leveraging resources with other states and the federal government in conducting debromination and toxicological studies will be absolutely necessary.

Responses

Fire safety. Ecology and DOH are confident that the methods and assumptions behind their ongoing Alternatives Assessment will assure that the current level of fire safety is maintained if Deca-BDE is banned; therefore no further risk assessment is necessary at this time. The support of the Office of the State Fire Marshal further supports this approach.

Economic impact. These issues are discussed in the *Responses to #11* and *#12*, p 18-19. Regarding online sales: we would do our best to minimize such sales through educational

campaigns. But we are limited by constitutional constraints, since online sales fall under the jurisdiction of interstate commerce.

Specifics of Deca-BDE ban. In the *Final PBDE CAP*, the recommendation is not limited to any specific type of product:

> *The Washington State Legislature should ban the manufacture, distribution (but not transshipment) or sale of new products containing Deca-BDE provided that safer alternatives are identified or upon the emergence of additional evidence of Deca-BDE harm.*

We recommend delaying the start date for a Deca-BDE ban which both impels manufacturers, as well as provides sufficient time for them, to develop safer alternatives; we agree with our commenter who feels that a ban on all products is necessary in order to drive innovation. Because we are still, as of this writing, looking for a safer, effective, affordable alternative, the effective date of the ban could not be in 2006.

Working with other states and the federal government. We agree with the commenter that the need to leverage resources for studies is critical; Ecology and DOH alone do not have the resources. We are following major studies being conducted in Europe and elsewhere, and are closely monitoring PBDE-related activities in the U.S. and around the world.

Section 3: Minimizing Human Exposure

Commenters: People for Puget Sound, Seattle Chapter Fellowship of Reconciliation, Toxic-Free Legacy Coalition, WCRC, WA Physicians for Social Responsibility, WTC, Amy Hirsch, Nancy Dickeman, Ivy Sager-Rosenthal, Lindsay Datelund, Mary Ann O'Hara, Laurie Valeriano, Michael Abbier, Linda Greene

Summary of comments

- Currently, there are no labeling requirements for products containing deca-BDE. Labeling is needed to ensure that consumers can make an informed choice about whether to buy a product containing deca-BDE until the ban is in place. In addition, labeling will allow retailers to know whether they are in compliance with the ban and help facilitate the proper disposal of the product. It will also enable recyclers to ensure that the product is properly managed at the end-of life stage. Ecology and DOH should recommend that products containing Deca-BDE should be labeled as such.
- To be consistent with the state dangerous waste regulations, labeling should be required for all products containing halogenated flame-retardants. This would provide consumers with important information and help ensure proper waste disposal.
- Toxic flame retardants (PBDEs) are unacceptable to the people affected, even if tracing cause and effect is blurred. If the science is solid, act now, not in a delayed schedule. If a compromise must be made, consider taxing the source of the problem (consumer demand), and use the money to pay for best estimates of the health costs, and for retraining workers possible affected, and for bonds to retool industry towards cleaner alternatives.

- The State should lead by example. General Administration and other state agencies should specify that goods purchased on state contracts not contain any PBDEs, including Deca-BDE. The current state purchasing recommendation falls short by specifying only Penta- and Octa-BDE, which are being phased out anyway.
- Require Washington state to give preference in state contracts to products that do not contain Deca-BDE. The recommendation on state purchasing for Deca-BDE should be strengthened to require the Department of General Administration to specify a preference for products that do not contain Deca-BDE. This is consistent with Section 5 of Governor Locke's Executive Order 04-01, which requires the Department of General Administration to give preference to products that do not contain PBTs when purchasing equipment, supplies, and other products on state contracts.

Responses

Labeling. Labeling was considered, but ultimately we decided that a ban would be much more effective. Labeling would likely require legislative action. Therefore, labeling was a second best choice and still is.

Taxing. As part of the final recommendation for Deca-BDE in the *Final PBDE CAP* we state: "If safer alternatives are not found in a reasonable time, Ecology and DOH should work with stakeholders to develop incentives/disincentives to encourage manufacturers to identify safer alternatives or product design changes that eliminate the need for PBDEs." (p94) Taxing certainly could be considered at that time as a possible disincentive.

State purchasing. In the *Final PBDE CAP*, the recommendation was revised to the following: "Consistent with Executive Order 04-01, restrict the state's purchase of PBDEs in appropriate contracts. General Administration should prefer products that do not contain Deca-BDE."

Section 4: Monitoring and Research

Commenters: AeA, King County, NBMA, NEW, People for Puget Sound, Pierce County PWU, PSAT, TPCHD, Total Reclaim, WCRC, WA Physicians for Social Responsibility, WTC

Summary of comments

- The prudent action is to monitor ongoing research with respect to Deca-BDE and other flame retardants and to base any future decision on a sound scientific basis.
- We [NEW] concur with the recommendation for biomonitoring of blood and breast milk for PBDEs and other toxic substances. Such programs would serve as early warning systems to catch emerging toxic exposures; they would also provide indicators of success in reducing sources of exposure. We are also gratified to see consideration for biomonitoring the blood of workers who may be exposed to PBDEs, and if funding is an issue to pursuing this line of investigation, suggest coordinating with federal agencies such as the Center for Disease Control (CDC).

- Research on the human health impacts of PBDEs should be the highest priority in Ecology and DOH's approach to PBDEs.
- We [WA Physicians for Social Responsibility] strongly support your recommendations for human health monitoring and particularly recommend that regional monitoring not only be explored, but is needed, and recommend that DOH undertake state biomonitoring. Biomonitoring provides vital information for assessing exposure levels regionally, and as noted in the plan, for identifying at-risk populations. Given this, we also recommend consideration of methods to monitor that would yield the best results for at-risk populations.
- Environmental monitoring should include: the testing of sediments, marine mammals and other wildlife, predatory birds, incinerators, wastewater, biosolids and air in addition to tissue sampling from resident and migratory fish (including bottom dwelling, forage fish and salmon). Fish tissue monitoring should not be for just PBDEs but expanded to all PBTs.
- The TPCHD recommends that the final plan emphasize data collection to further support data-driven policies, supports efforts to require disclosure of PBDEs in products, and applauds efforts to reduce or eliminate the production and use of PBDEs (and other PBTs).
- The recommendations include numerous references to having DOH and L&I measure and monitor occupational exposures to PBDE fire retardants: there is certainly a need to identify, monitor, and possibly regulate the exposure to these materials. Unfortunately, it seems that there is very little research on the actual health impacts or toxicology of exposure to PBDEs. With no data on the risk and possible harm from exposure, how can DOH and L&I develop standards for exposure that have any basis in reality? To say it another way, just because we can measure it, does it mean it represents overexposure and needs to be regulated? Prior to developing a monitoring and testing regime, DOH, L&I, or other agencies should provide information on the risk these materials pose to humans and regulatory exposure levels.
- Blood testing for PBDEs is expensive. Where the toxicology of materials is understood, as with lead or mercury, expensive testing may be justified, as it will protect employees from known dangers. In this case, there is no quantitative basis for evaluating occupational risk, and this requirement would likely place a significant burden on companies without a recognizable benefit.
- Expanding on the (draft) Plan's recommendation to research alternatives to brominated fire retardants – the King County Local Hazardous Waste Management Program recommends that upon completion of such research, the State list those alternatives as the only acceptable fire retardants for use in products manufactured, sold, or distributed in Washington State.
- Establish an institute in the Washington State university system to research alternatives to PBDEs along with other persistent, toxic chemicals. Because of the failure of U.S. chemicals policy, little is known about some of the alternatives to PBDEs, and yet it is important that Ecology and DOH investigate alternatives. Establishing such an institute would ensure substitutes for toxic flame retardants are safe, help encourage business innovation, establish Washington State as a leader in "clean product design and production," and assist businesses in finding alternatives to PBDEs and other persistent toxic chemicals.

- There should be a recommendation to research the fate of PBDEs in solid waste incinerators and other burn facilities. This should include testing incinerator air emissions and ash for PBDEs as well as brominated dioxins and furans. Ecology should use its authority to immediately require this testing by the Spokane incinerator and the Tacoma incinerator (if it proposes to reopen).
- The exposure pathways for PBDEs need to be understood and the fates of the various congeners of PBDEs known before one can decide what and when to monitor.
  - The NBMA believes that the recommendation that Ecology monitor biosolids for PBDE content be delayed or dropped until it is determined if biosolids is an important pathway for exposure.
- We [WTC] support the recommendation to revise federal chemical policy, however, more information on chemicals is not the only change that needs to occur. Ecology and DOH should support the following principles with respect to reforming national chemicals policy as part of the PBDE plan:
  - Require Safer Substitutes and Solutions -- seek to eliminate hazardous chemical use and emissions by altering production processes, substituting safer chemicals, redesigning products and systems, and rewarding innovation. Safer substitution includes an obligation on the part of the public and private sectors to invest in research and development for sustainable chemicals, products, materials, and processes.
  - Phase-out Persistent, Bioaccumulative, or Highly Toxic Chemicals – prioritize for elimination chemicals that are slow to degrade, accumulate in fatty tissues, or are highly hazardous to humans or the environment.
  - Give the Public and Workers the Full Right-To-Know -- label products that contain hazardous chemicals, list quantities of hazardous chemicals used in agriculture and in manufacturing facilities, and provide public access to safety data on chemicals. Also require manufacturers to report the amount of hazardous chemicals they use each year.
  - Act on Early Warnings -- act to prevent harm when credible evidence exists that harm is occurring or is likely to occur, even when some uncertainty remains regarding the exact nature and magnitude of the harm.
  - Require Comprehensive Safety Data for All Chemicals -- assume that a chemical is highly hazardous unless comprehensive safety data are available for the chemical and require manufacturers to provide this data by 2015 for a chemical to remain on the market -- this is the principle of "No Data, No Market."
  - Take Immediate Action to Protect Communities and Workers – when communities and workers are exposed to levels of chemicals that pose an immediate health hazard, immediate action is necessary to eliminate these exposures.

Responses

Ecology and DOH appreciate the extensive and thoughtful comments received, and will consider them carefully as we move forward with monitoring and research efforts. Our current plans for monitoring are included in the responses, below.

Human health monitoring. DOH will continue to coordinate with federal agencies on existing national biomonitoring, explore whether additional regional biomonitoring is needed, and research public awareness and perspectives to assure correct message development and environmental health communications strategy. In addition, DOH and L&I plan to implement a two-phase workplace exposure study in collaboration with the Centers for Disease Control.

Measuring and monitoring occupational exposures. The goal of performing workplace exposure monitoring for PBDEs is not to develop standards for exposure. The commenter is correct in that we do not currently have sufficient toxicity data to determine the health effects associated with a given level of exposure. The intent of this monitoring is to determine the relative contribution of PBDEs from the workplace compared to background exposures. Occupational studies of PBDE exposures have mostly been conducted in Sweden; exposure studies done there suggest that workers in an electronics recycling facility had higher plasma PBDE levels than hospital cleaners and computer clerks (the two control groups).

Given that the PBDE plasma levels in the U.S. general population exceed the levels observed in the rest of the world, it becomes important to determine whether U.S. workers have a higher PBDE body burden than the general U.S. population. The U.S. workers that likely deserve attention are those involved with handling PBDE-containing materials at end-of-life, such as workers involved in recycling plastics and foams, and generating auto fluff from recycled vehicles. While we do not have any standards against which to compare the measured levels, these data would help determine whether: 1) U.S. workers have higher plasma PBDE levels than the general population, and 2) exposure controls are warranted to reduce exposures in U.S. workers. The commenter is referred to L&I's fact sheet at http://www.lni.wa.gov/Safety/Topics/AtoZ/polybrom/default.asp.

Environmental monitoring. We recognize the need for environmental monitoring and have conducted a baseline monitoring program for PBDEs in Washington's environment, to be finalized in June 2006. We plan to maximize use of limited funds and use existing systems for multi-agency coordination (for example, the Puget Sound Ambient Monitoring Program, PSAMP) to develop a multi-media monitoring program for PBDEs. Environmental monitoring will include monitoring of fish for PBDEs. (Fish consumption has been identified as an important route of human exposure to PBDEs). We do not currently have funding for a broader monitoring program that addresses all PBTs, but we are aware that this is a significant need.

EOL work. The goal of our EOL work is to evaluate whether our current practices (disposal, recycling, reuse) are adequately protective. We have a small amount of money for monitoring in support of this work, to help make determinations on how we manage PBDE-containing waste.

Researching the fate of PBDEs in solid waste incinerators. Depending on the combustion conditions, incineration can destroy PBDEs. The concern is that brominated dioxins and furans may be produced in the process. Dioxins and furans are currently measured on a yearly basis at the Spokane incinerator, as part of the construction permit (which is issued for the life of the project). A risk assessment on nine years of data determined that the risk to the general public by these dioxins and furans was low. PBDEs are not currently included in the yearly testing; it would require a rule change to require PBDE testing as part of the permitting process. Under

current regulations, PBDEs are not considered toxic air pollutants. Incineration is a management strategy for EOL and will be considered further in the context of that work.

Research. Ecology and DOH will encourage other government agencies and research institutions to conduct research on the following issues:

- Deca-BDE debromination in various environments.
- The fate of PBDEs in the landfill environment.
- Alternative, non-brominated flame retardants, including their current presence in the environment and biological organisms, including people, to establish a baseline for future studies.
- Product design and other solutions to chemical fire retardants.
- A better characterization of how people in the U.S. are being exposed to PBDEs. This should include further monitoring of PBDEs in U.S. foods, identifying sources and levels of PBDEs in homes and other buildings, and identifying behaviors that contribute to PBDE levels in human tissues.

Once safer alternatives are found, require that products manufactured, sold or distributed in Washington must use only those flame retardants. We appreciate this idea, however, it is beyond the scope of our authority. We could list "recommended" flame retardants, or recommend restructuring the product to meet fire safety requirements without the need for flame retardants. However, we cannot make recommendations without incurring legal liability. For example, Ecology's Hazardous Waste and Toxics Reduction Program publishes a list of waste handlers on our website. We don't recommend or not recommend any facility, we just list where they are and what they do. We could do something similar for flame retardants, but no more.

Establish an institute. The scope of the *PBDE CAP* is limited to what we can do about PBDEs. We agree that establishing an institute, like the one in Massachusetts, is an excellent model for addressing these issues, but such a recommendation is beyond the scope of this PBDE-specific plan.

Reforming national chemical policy. We appreciate the thoughtful comments on principles for reforming national chemical policy, however, they are beyond the scope of the *PBDE CAP*. Our recommendations on U.S. Chemical Policy (*Final PBDE CAP*, p94-96) are the extent to which we can go at this time on some of these more overarching issues.

NOTE: Appendixes B and C contain copies of all the original comment letters received. They are very large files (over 500 pages in total), and are therefore in a separate publication available online at http://www.ecy.wa.gov/biblio/0607014b.html

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2006

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