Ecology PBT Working List: Responses to Public Comments on Appendix E

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3. The *Ecology Responses to Public Comments Received on the Draft PBT Strategy* (December 2001) is available at http://www.ecy.wa.gov/biblio/0103035.html

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by

Environmental Assessment Program
Washington State Department of Ecology
Olympia, Washington 98504-7710

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Abstract

Since 1998, the Washington State Department of Ecology (Ecology) has proposed three lists or listing processes of persistent, bioaccumulative toxins (PBTs) with varying degrees of supporting information:

1. In August 1998, Ecology distributed a proposed list that included 27 persistent, bioaccumulative, toxic chemicals. This list was developed by the Ontario Ministry of Environment in 1994. Under the 1998 proposal, the list was designed to identify those chemicals that Ecology believed should be virtually eliminated from Washington sources.

2. Ecology received numerous comments on this proposal and elected to make significant changes prior to releasing a *Draft PBT Strategy* for public review in August 2000. In particular, Ecology proposed to initially focus on 9 of the 12 PBT chemicals identified by the U.S. Environmental Protection Agency (EPA) in the National PBT Strategy.

3. Ecology proposed to identify additional PBT chemicals using the Waste Minimization Prioritization Tool (WMPT) and information on environmental concentrations and releases. Ecology evaluated a list of 66 chemicals identified in the WMPT as having a "PBT characteristics score" of 7, 8, or 9. The approach is outlined in Appendix E of Ecology's *Proposed PBT Strategy* (December 2000) that was submitted to the Washington State Legislature for approval and funding in January 2001.

The primary focus of this document is the public comments submitted to Ecology in March 2001 on Appendix E of the *Proposed PBT Strategy* (December 2000). When evaluating those comments and preparing responses, Ecology has also considered comments received on the *Draft PBT Strategy* (August 2000) that are relevant to identifying and ranking PBT chemicals. Ecology reviewed both sets of comments and identified (1) the programmatic issue areas listed above and (2) issues and concerns associated with specific chemicals or chemical groups. For each group of comments, Ecology has summarized the relevant portions of the *Proposed PBT Strategy* and summarized the comments related to that issue. Where multiple comments were received on a particular issue, an attempt was made to summarize each of the major concerns and provide examples of individual comments.

Ecology received numerous public comments on the proposed PBT chemical list and methods for amending that list that were distributed in August 2000 and the revised approach distributed for review in January 2001. Not surprisingly, the opinions on this topic varied widely, reflecting substantial disagreement on the relative merits and reliability of various approaches for identifying PBT chemicals.

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I. Introduction

Background

In August 1998, Ecology announced plans to develop a long-term strategy to reduce and eliminate certain chemicals that accumulate in human and animal tissues. As a starting point, Ecology proposed focusing on the 27 substances identified by the Province of Ontario's Ministry of Environment. A number of organizations and individuals submitted comments on that proposal. While there was considerable support for Ecology's proposal, commentors also identified numerous concerns. These ranged from concerns about the applicability of the "Ontario List" to questions about which pollutants to include or exclude from the list. In response to those comments, Ecology evaluated several approaches for developing a targeted list of PBT chemicals. That evaluation produced the revised approach included in the August 2000 draft strategy. The August 2000 draft approach contained two main elements:

- *Starter List of PBT Chemicals:* Ecology proposed to focus on nine chemicals/groups of chemicals that met three criteria: (1) identified in USEPA's National PBT Strategy, (2) found in Washington, and (3) used or produced in this state.

- *Process for Identifying Additional PBT Chemicals:* Ecology proposed to develop a Washington system for identifying and ranking PBT chemicals (based on USEPA's Waste Minimization Prioritization Tool (WMPT) and use that system to identify, rank and prioritize PBT chemicals. Ecology also proposed to use this prioritized list to guide resource allocation for chemical-specific action plans and monitoring.

Ecology received numerous comments on the August 2000 draft approach. After evaluating those comments, Ecology elected to further modify the draft approach. Specifically, Ecology decided to move forward to implement the identification and ranking process during the current biennium. Under this modified approach, Ecology proposed the following 4-step process:

- *Identification of Candidate Chemicals:* Ecology proposed to use the WMPT to identify candidates for inclusion on the Washington PBT list. Under the January proposal, a chemical must score at least 2 (out of a possible 3 for each of the "persistence (P)", "bioaccumulation (B)" and "toxicity (T)" characteristics and must have a total score of at least 7 out of a possible 9 in order to be included on the Candidate List.

- *Screen Candidate Chemicals:* Ecology proposed to evaluate available data on environmental concentrations, uses, and/or source releases in order to determine which Candidate Chemicals should be included on Washington's PBT list.

- *Rank PBT Chemicals:* Ecology proposed to use available information on chemical characteristics, environmental levels and potential sources to rank the PBT chemicals;

- *Prioritize PBT Chemicals:* Ecology proposed to prioritize the PBT chemicals for action plan development based on the chemical ranking, programmatic concerns, and opportunities for reductions.

The modified approach was distributed for additional public review in January 2001.

Public comments

Ecology received numerous public comments on the proposed PBT chemical list and methods for amending that list that were distributed in August 2000 and the revised approach distributed for review in January 2001. Not surprisingly, the opinions on this topic varied widely, reflecting substantial disagreement on the relative merits and reliability of various approaches for identifying PBT chemicals. For the purpose of reviewing, analyzing, and responding to comments on this topic, Ecology has divided the comments into several categories of issues. These include:

General comments

Issue 1:	What is the purpose of the PBT Working List?
Issue 2:	Should Ecology limit the PBT Working List to those PBT Chemicals identified by the Environmental Protection Agency?
Issue 3:	Should Ecology use the Waste Minimization Prioritization Tool (WMPT) to identify PBT chemicals?
Issue 4:	Is the PBT Strategy applicable to metals?
Issue 5:	Is it appropriate to use the Waste Minimization Prioritization Tool (WMPT) to evaluate metals?
Issue 6:	Is Ecology's proposal consistent with other approaches and programs?
Issue 7:	Has Ecology provided the public with an adequate opportunity to review and provide comments on the PBT Working List?
Issue 8:	Will the PBT Working List create unreasonable adverse impacts?

Comments related to preparing the PBT Working List

Issue 9:	What criteria should Ecology use to prepare the PBT Working List?
Issue 10:	What criteria should Ecology use to evaluate environmental persistence?
Issue 11:	What criteria should Ecology use to evaluate bioaccumulation potential?
Issue 12:	What criteria should Ecology use to evaluate carcinogenicity?
Issue 13:	What criteria should Ecology use to evaluate non-cancer health effects?
Issue 14	What criteria should Ecology use to evaluate ecological toxicity?
Issue 15:	Should Ecology include chemicals on the PBT Working List if there is limited or no evidence that they are present or used in Washington?
Issue 16:	Is it appropriate to exclude chemicals from the PBT Working List if their sources and/or uses are prohibited or otherwise restricted through current regulatory programs?
Issue 17:	Has Ecology used current scientific and technical information to prepare the PBT Working List?

Comments on individual chemicals included on the PBT Working List

Issue 18: Should Ecology include aldrin on the PBT Working List?

Issue 19: Should Ecology include cadmium on the PBT Working List?

Issue 20: Should Ecology include chlordane on the PBT Working List?

Issue 21: Should Ecology include DDT on the PBT Working List?

Issue 22: Should Ecology include dicofol on the PBT Working List?

Issue 23 Should Ecology include dieldrin on the PBT Working List?

Issue 24 Should Ecology include dioxins and furans on the PBT Working List?

Issue 25: Should Ecology include endosulfan on the PBT Working List?

Issue 26: Should Ecology include heptachlor epoxide on the PBT Working List?

Issue 27: Should Ecology include hexachlorobenzene on the PBT Working List?

Issue 28: Should Ecology include hexachlorobutadiene on the PBT Working List?

Issue 29: Should Ecology include hexachlorocyclohexane (Lindane) on the PBT Working List?

Issue 30: Should Ecology include lead on the PBT Working List?

Issue 31: Should Ecology include mercury on the PBT Working List?

Issue 32: Should Ecology include methoxychlor on the PBT Working List?

Issue 33: Should Ecology include pendimethalin on the PBT Working List?

Issue 34: Should Ecology include pentabromo diphenyl ether on the PBT Working List?

Issue 35: Should Ecology include pentachlorobenzene on the PBT Working List?

Issue 36: Should Ecology include pentachloronitrobenzene on the PBT Working List?

Issue 37: Should Ecology include polyaromatic hydrocarbons (PAHs) on the PBT Working List?

Issue 38: Should Ecology include polychlorinated biphenyls (PCBs) on the PBT Working List?

Issue 39: Should Ecology include 1,2,4,5-Tetrachlorobenzene on the PBT Working List?

Issue 40: Should Ecology include toxaphene on the PBT Working List?

Issue 41: Should Ecology include trifluralin on the PBT Working List?

Comments on individual chemicals not included on the PBT Working List

Issue 42: Should Ecology include arsenic on the PBT Working List?

Issue 43: Should Ecology include bis (2-ethylhexyl) phthalate (BEHP) on the PBT Working List?

Issue 44: Should Ecology include 4-bromophenyl phenyl ether on the PBT Working List?

Issue 45: Should Ecology include butyl-benzyl phthalate on the PBT Working List?

Issue46: Should Ecology include dibutyl phthalate (DBP) on the PBT Working List?

Issue 47: Should Ecology include di-n-octyl phthalate on the PBT Working List?

Issue 48: Should Ecology include nonyl-phenol on the PBT Working List?

Issue 49: Should Ecology include pentachlorophenol on the PBT Working List?

Issue 50: Should Ecology include polystyrene on the PBT Working List?

Issue 51: Should Ecology include vanadium on the PBT Working List?

Comments on PBT chemical ranking

Issue 52: Does the proposed ranking framework take into account an appropriate range of ranking factors?

Issue 53: Does the proposed ranking framework provide a reasonable approach for assigning points for PBT Characteristics?

Issue 54: Does the proposed ranking framework assign an appropriate amount of weight to PBT Characteristics?

Issue 55: Does the proposed ranking framework consider a reasonable range of information on the presence of individual chemicals in the Washington environment?

Issue 56: Does the proposed ranking framework consider a reasonable range of information on sources and releases of individual chemicals?

Issue 57: How should Ecology take into account data gaps?

Issue 58: Has Ecology proposed a reasonable approach for using the chemical rankings to establish priorities?

Organization of the document

Ecology's review and analysis of public comment has been divided into five sections.

- Section II addresses several general issues raised by the public related to Ecology's decision to prepare a PBT Working List.
- Section III addresses comments received on Ecology's proposed framework for identifying, ranking, and prioritizing PBT chemicals.
- Sections IV and V address comments received on chemicals that Ecology decided to include on the PBT Working List and chemicals Ecology decided NOT to include on the Working List, respectively.
- Section VI addresses comments received on Ecology's proposal for ranking individual chemicals and chemical groups.
- Section VII is a list of references.

The primary focus of this document is the comments on Appendix E of the proposed PBT strategy submitted in March 2001. When evaluating those comments and preparing responses, Ecology has also considered comments received in October 2000 that are relevant to identifying and ranking PBT chemicals. Ecology reviewed both sets of comments and identified (1) the programmatic issue areas listed above and (2) issues and concerns associated with specific chemicals or chemical groups. For each group of comments, Ecology has summarized the relevant portions of the January 2001 proposal and summarized the comments and concerns related to that issue. Where multiple comments were received on a particular issue, an attempt was made to summarize each of the major concerns and provide examples of individual comments.

Written comments are identified by the individual submitting the comment and the page of the written comments (e.g., Riley, p. 1). References cited by individual commentors are included as footnotes. Ecology received written comments from the following individuals in March and April 2001:

- Robert Fensterheim (APE Research Council)
- Dennis Hayward (Representing the Western Wood Preservers Institute)
- C.T. Howlett and Larry W. Rampy (American Chemistry Council/Chlorine Chemistry Council)
- Pam Johnson (People for Puget Sound)
- Neil King (Inco United States, Inc.)
- Jane C. Luxton (Lead Industries Association)
- Hugh Morrow (International Cadmium Association)
- Grant Nelson (Association of Washington Business)
- Courtney Price (American Chemistry Council Phthalate Esters Panel)
- Bonnie Rice and Philip Dickey (Washington Toxics Coalition)
- Daniel T. Riley (Western States Petroleum Association)
- J. Lawrence Robinson (Color Pigments Manufacturing Association)
- Bert Volger (Endosulfan Task Force/Ceres International LLC)

In addition, comments received from several individuals and organizations in October 2000 identified issues that are also addressed in this document. These include:

- Robin G. Bennett (The Boeing Company)
- Carol Dansereau (Washington Toxics Coalition)
- Pete Hildebrandt
- Lincoln C. Loehr
- Grant Nelson (Association of Washington Business)

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II. Summary of General Comments and Ecology's Responses

1: What is the purpose of the PBT Working List?

Over the last three years, Ecology has proposed three different lists and/or listing processes with varying degrees of supporting information. In August 1998, Ecology distributed a proposed list that included 27[1] persistent, bioaccumulative, toxic chemicals. Under the 1998 proposal, the list was designed to identify those chemicals that Ecology believed should be virtually eliminated from Washington sources[2]. Ecology received numerous comments on this proposal and elected to make significant changes prior to releasing a revised strategy for public review in August 2000. In particular, Ecology proposed to initially focus on nine of the twelve PBT chemicals identified by the Environmental Protection Agency (EPA) in the National PBT Strategy.[3,4] Ecology also proposed to identify additional PBT chemicals using the Waste Minimization Prioritization Tool (WMPT) and information on environmental concentrations and releases. In contrast to Ecology's earlier proposal, the August 2000 draft strategy did not include specific goals or timelines and acknowledged that actions to reduce PBT chemicals would vary from chemical-to-chemical.

The proposed strategy submitted to the Washington State Legislature in January 2001 built upon Ecology's two earlier proposals. In that document, Ecology (2000b) described a process to "…identify priority PBTs for the state of Washington…" However, that document did not provide a clear statement on the purpose of the PBT list (i.e., what is the significance associated with being identified as a "priority PBT"), except to state that, after public review and comment, "…the department will review comments and make a final determination on which chemicals will be assigned for further reduction actions via chemical action plans or program-specific priorities or opportunities." Consequently, it is not surprising that there appeared to be some confusion on this issue (i.e., how Ecology intended to use the PBT Working List). In particular, many of the comments appeared to reflect the underlying assumption that Ecology was using the listing process in a manner similar to the purpose outlined in the August 1998 proposal (i.e., to identify chemicals and/or chemical groups that the Department believes should be virtually eliminated from new and existing sources). For example:

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[1] Ecology proposed to focus on the 27 substances identified by the Ontario Ministry of the Environmental as candidates for virtual elimination.

[2] The August 1998 proposal included three key timelines: virtually eliminate PBT chemicals in new sources by 2005; virtually eliminate PBT chemicals from existing sources by 2020; and control discharges of PBT chemicals from cleanup sites by 2025.

[3] EPA issued a draft PBT strategy in November 1998. In the draft plan, EPA identified 12 priority PBT pollutants for the agency would develop national action plans for preventing and reducing releases. The 12 priority PBT pollutants included: aldrin/dieldrin; benzo[a]pyrene; chlordane; DDT; hexachlorobenzene; alkyl-lead; mercury compounds; mirex; octachlorostyrene; PCBs; dioxins and furans; and toxaphene. Ecology did not include alkyl-lead, mirex and octachlorostyrene on the August 1998.

[4] Ecology proposed to develop chemical action plans for these nine chemicals. These chemical action plans (in combination with several other general activities) replaced the remove the virtual elimination timelines included in the August 1998 proposal.

It is important not to lose sight of the fact that the draft WMPT PBT screening criteria (and associated scoring scheme) were developed as a tool for prioritizing chemicals for voluntary waste reduction efforts under EPA's national RCRA waste minimization policy. The WMPT goal is quite different than the goal being pursued by Ecology. There is a far greater difference between voluntary waste minimization efforts, which WWPI supports, and the far-reaching regulatory measures that are contemplated under Ecology's PBT policy…. (Hayward, p. 2)

Ecology's review and analysis of public comments on Issue 1

The primary purpose behind Ecology's efforts to develop the PBT Working List has been to identify chemicals that the Department believes may require greater attention because of their persistence, bioaccumulation potential and toxicity characteristics. In contrast to earlier proposals, a decision to include a chemical on the PBT Working List will not trigger a specific set of reduction goals or schedules. Indeed, the reduction goals and requirements for chemicals appearing on the PBT Working List will vary from chemical to chemical.[5] Ecology intends to use the PBT Working List in the following three ways:

- *Chemical Action Plans:* Ecology will use the PBT Working List to identify chemicals for which the Department will prepare chemical-specific action plans. Chemical-specific action plans are a central feature of the PBT Strategy and provide a mechanism for identifying and evaluating additional measures to reduce and, where possible, eliminate current sources and uses of individual PBT chemicals. As a first step, Ecology is preparing a chemical action plan to evaluate measures for reducing mercury uses and releases beyond those being achieved through the implementation of current environmental programs.

- *Voluntary Measures:* Ecology will use the PBT Working List to identify PBT chemicals that are priorities for voluntary reductions. This is consistent with the primary purpose behind EPA's efforts to identify PBT chemicals as part of the National Waste Minimization Plan.[6]

- *Information Collection and Dissemination:* Ecology will use the PBT Working List to identify PBT chemicals that are a priority for additional monitoring and/or other information collection activities. In most cases, additional information on sources, uses and environmental concentrations will be needed to support decisions on chemical-specific action plans and voluntary measures. The PBT Working List also provides a mechanism for increasing public awareness on the problems associated with PBT chemicals and steps that individuals and communities might take to reduce PBT chemicals and uses. This is particularly important given that further reductions in sources and uses will often necessitate changes in consumer behavior.

[5] For some chemicals (e.g., banned pesticides), there may only be limited (if any) actions beyond those being implemented under current environmental programs.

[6] Under the Government Performance and Results Act, EPA has committed to reduce PBT chemicals in hazardous waste by 50% by the year 2005 (relative to a 1991 baseline). In 1998, EPA published a draft RCRA PBT List that was designed to help guide voluntary waste minimization efforts. That rule has not been finalized. However, EPA is currently working on a revised list that is scheduled to be published as agency guidance in spring 2002.

As stated above, Ecology's efforts to develop the PBT Working List have evolved over a three year period from 1998 to 2001. The Department expects the list will evolve further based on additional environmental and source data, new information on the characteristics of individual chemicals becomes available and public dialogue on the initial list. The list's title (PBT Working List) was chosen to emphasize that the list represents a "working" or "living" document that will continue to evolve over time.

2: Should Ecology limit the PBT Working List to those PBT Chemicals identified by the Environmental Protection Agency?

In the August 2000 draft strategy, Ecology proposed to (1) focus its initial efforts on nine of the 12 chemicals/groups of chemicals identified by the Environmental Protection Agency in the National PBT Strategy and (2) identify additional PBT chemicals using the Waste Minimization Prioritization Tool (WMPT). In the January 2001 proposal, Ecology proposed to accelerate listing efforts and develop the more comprehensive PBT Working List by the end of 2002. The January proposal identified 66 candidates PBT chemicals that Ecology proposed to consider for inclusion on the initial list.

Comments on Ecology's August 2000 and January 2001 proposals reflect two differing viewpoints. On one hand, citizen and environmental groups argued that Ecology should establish a comprehensive list. For example, several groups criticized Ecology's August 2000 proposal to focus on chemicals identified by EPA and recommended that Ecology expand the "Starter List" to include all of the 27 pollutants on the Ontario list and other high priority chemicals (e.g., lead). For example:

The Need for a Comprehensive List. As a matter of sound science, failing to use the full list of 27 chemicals which Ecology originally proposed makes no sense whatsoever. All of the chemicals on that list are widely accepted to be persistent, bioaccumulative, and highly toxic. Ignoring endosulfan, pentachlorophenol, cadmium, and the other now-missing PBTs will not make them go away in our environment and our children's lives. All PBTs need to be addressed, not just a handful. A chemical of the day approach fails to give our children and others the comprehensive protection they deserve.

The chemical of the day approach also fails to make sense in terms of agency and societal resources. We know that the other chemicals on the list of 27 are PBTs. The list was derived by scientists using conservative criteria and is widely accepted as valid. We shouldn't waste resources and time reinventing the wheel. Yes, we may prioritize some chemicals for focus activities. But the list of PBTs should be inclusive at the outset, with a clear and efficient process established to add to it. (Dansereau, pp. 3-4 of comments on August 2000 draft strategy)

Consistent with their earlier comments, environmental and citizen groups were generally supportive[7] of the proposed approach submitted to the Washington Legislature in January 2001.

[7] Although environmental organizations appeared to support the general approach, they identified concerns with specific aspects of the proposal (e.g., screening the list based on presence in the Washington environment). These concerns are discussed elsewhere in this document.

On the other hand, business and trade organizations urged Ecology to focus on the chemicals identified by EPA and/or the United Nations Environmental Program (UNEP). In general, individuals representing these organizations expressed support for Ecology's August 2000 proposal. For example:

The state PBT strategy should, initially, follow the EPA program…We support the DOE approach of using the federal PBT list and method for adding to it. It is also beneficial to build on the EPA action plans rather than create new ones that may be duplicative. It is recommended that the state follow EPA in this new area of activity and add to, or vary from, the national effort only after clearly defining unique state problems that are not being addressed. Legislative approval of deviations from the federal program would be desirable for at least the first five years. (Hildebrandt, p. 3 of comments on August 2000 draft strategy)

Consistent with their earlier comments, many of these same individuals and organizations expressed the opinion that Ecology was premature in its efforts to identify additional PBT chemicals beyond those identified by EPA and the United Nations Environmental Program. For example:

…[t]he draft PBT Strategy places too much emphasis on adding substances, rather than focusing on actions the State can undertake on the consensus PBTs (e.g., chemicals listed under the U.N. Stockholm Treaty on Persistent Organic Pollutants)….We strongly recommend that the State of Washington restrict its initial attention to a smaller initial list of PBTs, and add substances only after gaining experience with the program. (Howlett and Rampy, p. 3)

Ecology's review and analysis of public comments on Issue 2

Ecology has reviewed and analyzed the comments that the Department has received on this issue over the last three years. Based on that evaluation, Ecology continues to believe that it is appropriate for the Department to develop a PBT Working List that includes chemicals that meet Washington's listing criteria independent of whether they are included on the EPA list. The primary reasons for developing a Washington-specific list include the following:

- *Ecology believes that the Washington PBT strategy should focus on PBT chemicals that pose potential environmental threats in Washington.* This position was strongly endorsed during the public meetings held in 1998, 1999 and 2000. Indeed, there was considerable opposition to Ecology's initial listing proposal[8] because people argued that it was inappropriate to use a list that had been developed for a different part of the country (e.g., the Great Lakes region). Consequently, Ecology finds it somewhat surprising that many of the individuals criticizing Ecology's 1998 proposal are now urging the Department to use the National PBT list which is limited to the Level I Substances identified in the Great Lakes Binational Toxics Strategy (GLNPO, 1997). In addition, there is little (if any) evidence that three of the twelve chemicals appearing on the EPA list have actually been used or released in Washington. Conversely, there are a number of other chemicals not included on the Federal PBT list that

[8] In August 1998, Ecology announced its intent to develop a PBT strategy to address the 27 chemicals identified by the Ontario Ministry of the Environment.

are (1) used or released in Washington and (2) have "P", "B" and "T" characteristics that meet the criteria for being classified as PBT chemicals.

- *Ecology believes that the PBT Working List should reflect the multiple purposes of the Ecology PBT strategy.* As discussed under Issue 1, the PBT Working List is designed to meet several purposes. If the sole objective was to identify chemicals for which the Department intended to prepare chemical-specific action plans during the next several years, it might be appropriate to limit the initial list to those chemicals appearing on the EPA list and/or international lists. However, Ecology believes that focusing on these chemicals would compromise efforts to improve the information base on these types of chemicals, increase public awareness and encourage voluntary reduction measures. EPA (1999a) stressed the importance of matching listing criteria with program goals and objectives. They concluded (for purposes of the Toxics Release Inventory) that "…it would be inappropriate to merely adopt the criteria and list of chemicals managed under international programs because the purposes of the TRI program are different than the purposes of the cited international programs…." (EPA, 1999a).

3: Should Ecology use the Waste Minimization Prioritization Tool (WMPT) to identify PBT chemicals?

In August 2000, Ecology proposed to use the Waste Minimization Prioritization Tool (WMPT) to identify and rank additional PBT chemicals (i.e., beyond the nine chemicals included on the Starter List). In the revised strategy submitted to the Washington State Legislature in January 2001, Ecology also proposed to use the WMPT to develop the initial list. Many of the organizations and individuals providing comments on these proposals criticized Ecology's decision to use the WMPT to identify and rank PBT chemicals. For example:

We continue to be troubled by Ecology's intent to utilize the draft Waste Minimization Prioritization Tool ("WMPT") in developing a state-specific ranking system for PBTs. Although, we applaud Ecology's efforts to incorporate into WMPT a screen for environmental presence within the State, we do not believe the WMPT PBT screening and scoring criteria should be used…. (Hayward, p. 1)

….The WMPT is not an appropriate tool to use in screening and prioritizing additional PBTs. (Howlett and Rampy, pp. 1-2)

Several lines of reasoning were used by organizations and individuals urging Ecology to reconsider its use of the WMPT. First, several individuals and organizations argued that the WMPT is not consistent with approaches being used to identify PBT chemicals by international organizations. For example:

…the statistical distribution applied in the WMPT is not consistent with the criteria adopted internationally, in the North American region, or in other EPA-related programs. For example, the WMPT applies a technically unjustifiable 25-50-25 percent statistical distribution for persistence which makes the WMPT approach to persistence fundamentally non-criteria based. In contrast every other PBT-related program adopts specific criteria for identifying PBT

substances (i.e., persistence > 6 months in soil and sediment; bioaccumulation factor > 5,000 (or logKow > 5). The most recent international agreement affecting persistent organic pollutants adopts such a criteria-based approach…(Howlett and Rampy, p. 2)

Second, several organizations questioned the data used to develop the WMPT. For example:

….the WMPT includes flawed data for some chemicals, such that the WMPT might label as PBTs chemicals that do not actually meet the criteria. The separate comments filed by the Council's Phthalate Esters Panel, which we fully endorse, demonstrate this point. (Howlett and Rampy, pp 1-2)

The Software was released to the public prematurely without sufficient peer review from industry and risk experts with specialized knowledge concerning the chemicals ranked in the initial listing. (Robinson, p. 2)

…. Although EPA has not yet issued its final list of PBT Chemicals, we understand that some of the P, B or T numerical scores that EPA assigned to the chemicals in 1998 have been reviewed in response to public comments. We also understand that EPA has decided to raise the threshold for identifying PBT chemicals under the WMPT methodology from a total score of 7 to a total score of 8. Thus, by relying on EPA's September 1998 WMPT (and the associated chemical scores and rankings), the Department would be using criteria and results that EPA no longer endorses. (King, p. 2)

Third, several organizations noted that the USEPA developed the WMPT for a specific purpose and expressed the opinion that it was inappropriate to use the tool in other situations. For example:

EPA has publicly stated that the revised version of the WMPT was developed solely for the RCRA Waste Minimization PBT Chemical List and is not intended for other applications. "Waste Minimization Tool Spreadsheet Document for the RCRA Waste Minimization PBT Chemical List Docket (September, 1998). (Nelson, p. 3)

It is important not to lose sight of the fact that the draft WMPT PBT screening criteria (and associated scoring scheme) were developed as a tool for prioritizing chemicals for voluntary waste reduction efforts under EPA's national RCRA waste minimization policy. The WMPT goal is quite different than the goal being pursued by Ecology. There is a far greater difference between voluntary waste minimization efforts, which WWPI supports, and the far-reaching regulatory measures that are contemplated under Ecology's PBT policy. Indeed, for the limited and desirable purpose of waste minimization, it may make sense to adopt more expansive chemical selection criteria (although the criteria used by WMPT are far more extreme than those required). No one, not even the EPA office that developed WMPT, believes that its criteria should be used for the purposes of identifying true PBT chemicals with properties akin to the so-called Dirty Dozen. For that purpose, we believe only rigorous and science-based criteria are appropriate. (Hayward, p. 2)

….[I]t is our understanding that the 1998 WMPT was to be used for the sole purpose of supporting the RCRA Waste Minimization PBT Chemical List development and was not intended to support other applications at that time. Additional applications were to be discussed in a

re-release in 1999, but we are unaware if that occurred. It also appears that the WMPT is not in a final form. With these unknowns in the basic chemical scoring process, careful review of the applicability of the approach is necessary before it is applied to a broad PBT program. (Riley, p.1)

Fourth, several commentors argued that Ecology should not use the WMPT because the USEPA has never finalized the tool and now discourages its use by other organizations. For example:

First, EPA has never finalized the WMPT, and indeed has not even made a revised version of the Tool public. It is not clear if Ecology is contemplating using the original version of the WMPT, or an unpublished revision. …it is worth noting that not only has EPA withdrawn the publicly available version of the WMPT, the Agency is actively discouraging its use. For example, EPA requested that Environmental Defense (ED) remove any reference to the WMPT on ED's "scorecard" website ..(Howlett and Rampy, pp. 1-2)

Finally, several individuals expressed concerns that application of the WMPT would result in an excessive number of chemicals being identified as PBT chemicals.

Adoption of the draft WMPT PBT screening and scoring criteria is singularly inappropriate if one considers that 681 chemicals, or nearly one quarter of the 2500 chemicals evaluated under the draft WMPT, passed the screen for persistence, bioaccumulation, and toxicity. The large number of chemicals that passed the WMPT PBT screen demonstrates its lack of rigor. Indeed, roughly 80 percent of the chemicals designated as candidate PBTs under WMPT only exhibited moderate persistence (score of 2) and/or moderate bioaccumulation (score of 2) even under the modest fenceline criteria that were used by EPA. We do not believe that Ecology intends to employ the measures outlined under its PBT strategy to control chemicals with only modest persistence or bioaccumulation potential. Such measures should be reserved for those chemicals that are so persistent, so bioaccumulative, and so toxic as to justify the extraordinary expenditures contemplated by the PBT strategy.

It is also important to recognize that the draft WMPT criteria for defining persistence, bioaccumulation potential, and toxicity are more expansive than those used by the Province of Ontario's Ministry of Environment in its development of the Ontario list. In the Ontario scheme, a chemical could be designated a priority chemical if its bioaccumulation factor ("BCF") is 500 or greater, its half-life in the environmental media to which it largely partitions (partitioning half-lives) is greater than 50 days, and it has high toxicity to mammals or fish. Under the draft WMPT, a BCF (or BAF, as appropriate) of > 250 to < 1000 results in a bioaccumulation score of 2, and a BCF (or BAF) of > 1000 results in a bioaccumulation score of 3. Similarly, under the draft WMPT, a persistence score of 2 was applied to partitioning half-lives of 140-580 hours (5.8 – 24 days) and a persistence score of 3 was applied to regional half-lives or a greater than 580 (24 days) duration. Both the draft WMPT and the Ontario criteria for high toxicity are similar. Ecology has wisely rejected the Ontario methodology and it should reject the draft WMPT methodology for the same reasons. (Hayward, p. 2)

While the majority of individuals/organizations providing comments on this issue appeared to be concerned that its use would result in an inappropriately large number of chemicals being included on the list, the opposite viewpoint was also expressed. For example:

Ecology proposes to use these environmental presence and use/production screens to narrow a list generated with USEPA's Waste Minimization Prioritization Tool (WMPT). We fear that this tool itself may also unduly limit the PBT list. The purpose and genesis of the WMPT was reducing solid wastes, not dealing with discharges to air, water and products. A sidebar in the Ecology strategy notes that the WMPT has been criticized for this and that change is forthcoming, but those changes do not appear to have been adopted yet or even officially proposed. Even if good changes are made to the WMPT, the starting list that EPA generated which Ecology would work with could well be waste-slanted for the foreseeable future. (Danserau, p.)

Ecology's review and analysis of public comments on Issue 3

After reviewing the comments on this issue, Ecology agrees with those individuals who recommended that Ecology specify clear "P", "B" and "T" criteria for evaluating whether a particular chemical should be included on the PBT Working List. As discussed under Issues 9 through 15, Ecology has decided to include chemicals on the PBT Working List that have regional half lives greater than 580 hours, bioaccumulation factors/bioconcentration factors (BAF/BCF) greater than 1000 and human health or ecological toxicity values above the toxicity criterion used to assign EPA toxicity scores of 3. However, Ecology continues to believe that the technical information compiled in the WMPT support documents generally provides a solid technical basis for evaluating whether individual chemicals meet these criteria. As discussed in Sections IV and V, Ecology has used that information (along with information from other readily available sources) when deciding whether a particular chemical meets the criteria for persistence, bioaccumulation, and toxicity and, therefore, should be included on the PBT Working List. The rationale for this approach includes:

- *Ecology believes this approach is consistent with approaches used by other organizations:* As discussed under Issue 6, Ecology believes that this approach is consistent with approaches used by other programs. Similarities include: (1) all approaches consider persistence, bioaccumulation, and toxicity; (2) all approaches use similar approaches and data sets to characterize persistence, bioaccumulation, and toxicity; and (3) many of the same chemicals appear on several lists.

- *Ecology believes this approach represent a scientifically sound approach for evaluating PBT chemicals.* Although commentors have raised several technical issues (both general and chemical-specific) associated with the WMPT, Ecology believes the model is based on sound scientific principles, uses current scientific data, takes into account the validity of available data (in terms of greater reliance on measured vs predicted values) and is well documented[9]. In preparing the WMPT, EPA conducted an extensive technical and public review. EPA's evaluation and response to public comments on the beta version of the model reveals a sophisticated understanding of the scientific and technical issues associated with developing and using the model. Indeed, several of the concerns identified by commentors appear to reflect features of the beta version of the model that EPA elected not to include in the September 1998 version. With respect to the chemical-specific information forming the

[9] Finally, it is important to note that an equivalent level of documentation on the technical merits of other approaches identified during the public comment period (e.g., Ontario list, Great Lakes, United Nations) has not been made available to the public.

basis for listing individual chemicals, Ecology generally believes that the PBT Characteristics scores developed by EPA have a solid scientific foundation and that an exhaustive re-analysis of the EPA work is not necessary. In reaching that conclusion, Ecology recognizes that there are legitimate issues associated with interpreting available information on particular chemicals. However, Ecology believes that EPA has given careful consideration to the quality[10], variability[11] and uncertainty associated with available information when developing "P", "B" and "T" scores for individual chemicals. Ecology also acknowledges that information developed subsequent to 1998 might provide a basis for re-evaluating the persistence, bioaccumulation, or toxicity scores assigned to individual chemicals by EPA (1998c). Consequently, Ecology reviewed (1) the data tables prepared by EPA to support PBT Characteristic scores for individual chemicals and (2) readily available information developed subsequent to 1998.

- *Ecology believes that reduced reliance on the WMPT is appropriate given EPA's ongoing efforts to re-evaluate certain parts of the tool.* Given EPA's ongoing efforts to re-evaluate parts of the tool, Ecology believes it is reasonable to use a criteria-based approach for identifying chemicals to include on the PBT Working List. This modified approach will minimize (if not completely eliminate) the chances that future revisions will significantly change Washington's approach for identifying and ranking PBT chemicals.

4: Is the PBT Strategy applicable to metals?

In August 2001, Ecology proposed to focus on nine of the 12 chemicals/chemical groups identified by the Environmental Protection Agency in the national PBT strategy. Citizen and environmental groups recommended that Ecology expand the "Starter List" to include lead and cadmium[12]. For example:

In short, the list of 27 chemicals initially put forth by Ecology needs to be the starting list for the PBT initiative. We also reiterate our request that lead be added to this list bringing the total up to 28. Lead persists forever, builds up in bones, and is clearly toxic in minute concentrations. The sooner we begin to eliminate the use and release of lead, the sooner we can make progress in reducing the lead body burdens borne by so many children and others in Washington state and elsewhere. (Dansereau, pp. 3-4)

In the January 2001 strategy submitted to the Washington State Legislature, Ecology identified a list of 66 Candidate PBT chemicals to be screened and prioritized. The Candidate list included

[10] In developing the WMPT, EPA evaluated the various sources of chemical-specific information and assigned data preference rankings based on the level of confidence and/or data quality. EPA identified five data preference levels (highest, high, medium, low and lowest). The vast majority of chemicals included on the PBT Working List have been extensively studied and received data quality rankings of "high" or "highest".

[11] For many chemicals, there is a high degree of variability across studies, species and environmental conditions. For example, the BCF values for pentachlorophenol currently included in the EcoTox database range from 5 to 45,000. EPA has used a BCF value of 776 to characterize the bioaccumulation potential for this substance. This value corresponds to approximately the 75th percentile value.

[12] Cadmium compounds are included as one of the 27 substances/groups of substances on the list published by the Ontario Ministry of the Environment.

four metals – cadmium, lead, mercury and vanadium. Many of the comments[13] on the January document expressed the opinion that it was inappropriate to apply the PBT methodology to metals. Several lines of reasoning were used to support these arguments. First, several commentors expressed concerns that Ecology's proposal was inconsistent with conclusions reached by EPA and various international bodies. For example:

…We agree that releases of persistent, bioaccumulative, and toxic synthetic organic chemicals (PBTs) should be reduced, but we strongly concur with the Lead Industries Association's comments and the findings of the international scientific community that naturally occurring inorganic metals are not PBTs and should not be characterized as such. (Morrow, p. 1)

EPA's final rule establishing water quality guidelines for the Great Lakes System examined the issue of bioavailability for ten metals, including lead, cadmium and chromium, and found none to be bioaccumulative. (60 FR 15365 , 15393) (March 23, 1995) (King, p.3)

Second, commentors argued that metals should not be identified as PBT chemicals because they possess properties that are fundamentally different than organic compounds, are naturally present in earth's crust and (in some cases) essential for living organisms. For example:

Numerous observers have recognized the inapplicability of the PBT methodology to metals including EPA's science advisors, other executive branch agencies, academic researchers, members of Congress, and over 70 trade associations. For example, the World Wildlife Fund stated that the "PTB [PBT] concept… is not fully applicable to metals. All metals are persistent, can accumulate, and cause toxic effects. However, they are part of nature and many of them – but not all – are essential for living organisms. Thus, the PTB concept does not really allow for priority setting." In a May 2000 Advisory, EPA's Science Advisory Board noted that classification of metals as persistent, bioaccumulative toxicants (PBTs) is problematic, since their environmental fate and transport cannot be adequately described using models for organic contaminants. Further, Margaret Cavanaugh, the Director of the Inorganic, Bioinorganic, and Organometallic Chemistry Program at the National Science Foundation, observed that the PBT methodology "cannot be used for metals and metalloids because the persistence and bioaccumulation criteria do not apply and do not provide a sound basis for discriminating benign and harmful substances. (Luxton and Walsh, p. 3)

Third, several commentors argued that it was inappropriate for Ecology to include metals on the PBT Working List because they believed that the PBT methodology developed by EPA was not appropriate for evaluating metals. In particular, it was argued that metals are not harmful if they are not in a bioavailable form and that the failure to consider bioavailability might result in erroneous conclusions. While such concerns appeared to acknowledge that metals may pose problems similar to those posed by organic compounds, these individuals recommended that additional factors such as bioavailability be considered before reaching that conclusion for individual metals:

[13] In some cases, it was unclear whether the commentor was arguing that it was inappropriate to classify metals as PBT chemicals, arguing that the WMPT was not an appropriate tool for evaluating whether metals are PBT chemicals or both. Comments on the applicability of the WMPT to metals are discussed under Issue 5.

Metals present a special case. Species of metal compounds react very differently in terms of their bioaccumulative potential and toxicity. Some metal species, in fact, are considered nutrients which other species of the same metal may be harmful. If an elemental metal or category of metals meets the PBT criteria, then its individual, or at least most common species, should be further screened for bioavailability. If a specific metal compound is not determined to be bioavailable, then it should be excluded from the list and further consideration as a PBT since exposure potential will not be an issue. Therefore, any metals included on the RCRA PBT List should meet all three criteria for persistence, bioaccumulation, and toxicity, and be demonstrated to be bioavailable. (Perelman, Allen-Kellogg and Shipley[14], pp. 9-10 of the attachment to the comments submitted by the American Chemistry Council)

…the list of PBT Candidate Chemicals to be screened and prioritized under the program includes four metals – cadmium, lead, mercury, and vanadium. Mercury is a special case because it can be readily methylated in the environment, transforming into an organometallic compound, methylmercury, that exhibits the characteristics of organic PBT compounds. But the other three metals should not be identified as PBT chemicals. As a scientific matter, it is not appropriate to evaluate (and rank) the potential hazards of metals and inorganic metal compounds using the PBT methodology and criteria that were applied by EPA in the September 1998 WMPT. … (King, p. 2)

Ecology's review and analysis of public comments on Issue 4

Ecology has reviewed and analyzed the comments that the Department has received on this issue. Based on that evaluation, Ecology continues to believe that it is appropriate for the Department to include metals on the PBT Working List if they meet the listing criteria. The primary bases for this conclusion include the following:

- *Metals are persistent.* There are many definitions for "persistence" found in the scientific literature. Consistent with those definitions, Ecology (2000b) states "…[a] chemical is persistent in the environment if it breaks down slowly or not at all, causing it to remain for long periods of time." As pointed out by several commentors, metals do not degrade and, consequently, all elemental metals persist indefinitely in the environment. While many factors influence exposure and health impacts, the lack of significant environmental degradation creates a higher potential for exposure and adverse health impacts relative to chemicals that are transformed and/or degraded in the environment.
- *Metals have the potential to become bioavailable under common environmental conditions and have been shown to bioaccumulate in biological organisms.* There is considerable scientific evidence that metals are able to accumulate in biological organisms and reach levels sufficient to cause harmful effects.[15] However, Ecology agrees with commentors who

[14] A document titled "Comments of the Chemical Manufacturers Association on the Notice of Availability of Draft RCRA Waste Minimization PBT Chemical List" was included as an attachment to the comments from the American Chemistry Council. This document provides well-thought-out analyses and opinions on a variety of issues associated with the WMPT and its use. Ecology has included excerpts from that document as examples of concerns or perspectives on various issues. The authors of that document are Dell Perelman, Dorothy Allen Kellogg and Ron Shipley.

[15] Information on the accumulation of various metals are summarized and evaluated in the ambient water quality criteria documents prepared by the Environmental Protection Agency and chemical-specific profiles included in the

stated that bioavailability[16] is a critical factor in evaluating the potential for individual metals to bioaccumulate in organisms and that many physical, chemical, and biological factors affect the ultimate fate of metals in the environment. In particular, Ecology agrees that metals may exist in several different oxidation states that differ in terms of bioavailability and bioaccumulation potential. Indeed, under some conditions, metals may pose small risks to human health and the environment. However, Ecology also agrees with EPA's (1999a) conclusion that "…it is realistic to expect that, in general, metals when released into the environment can encounter conditions in which they are available at levels sufficient to exert toxicity and bioaccumulate." Available fish tissue data indicates that mercury, lead, and cadmium are bioavailable under at least some environmental conditions encountered in the State of Washington.

- *The metals that Ecology has chosen to include on the Washington PBT chemicals are not believed to be essential nutrients.* Several commentors argued against including metals on the PBT Working List because metals are natural components of the earth's crust and are accumulated (in many cases) because they are essential nutrients. While this may be true for many metals, there is little (if any) information to support such claims for cadmium, lead, and mercury. Even if such evidence was available, it is somewhat misleading to conclude that any amount of an essential element is acceptable or desirable because metals may be essential for certain functions at low levels, but also pose threats at similar or higher exposure levels.[17] In addition, there are considerable variations in the sensitivity of various species to individual chemicals. Consequently, the fact that a substance is essential for one organism at low doses does not eliminate the possibility that the same substance may cause harmful effects to other organisms.[18]

- *Metals have been identified as PBT chemicals by other scientific and regulatory organizations.* Several commentors argued that including metals on the PBT Working List is inconsistent with other federal and international approaches. However, there appears to be considerable precedent for identifying metals as PBT chemicals by federal and international organization organizations. As discussed under Issue 6 (Consistency with Other Approaches), there are several federal, regional and international organizations that have identified one or more metals as PBT chemicals. These organizations include the Great Lakes Binational Toxics Strategy (GLNPO, 1997), the Accelerated Reduction/Elimination of Toxics (ARET) program (Environment Canada, 1994), the EPA Waste Minimization Program (EPA, 1998d) and the EPA Toxics Release Inventory (TRI) Program (EPA, 1999a).

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document "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment: Status and needs. (EPA, 2000a)

[16] The issue of bioavailability is one of several issues being examined by EPA as it works with the Science Advisory Board to develop an agency-wide approach for metals.

[17] In discussing this issue, EPA (1999a) noted "…[a]ccumulation of essential elements is usually governed by homeostatic mechanisms that control uptake (Ref. 28), but excessive uptake is possible and can be toxic to an organism. For example, selenium which is a micronutrient can cause selenosis at doses as low as 0.023 milligrams per kilogram per day. Clinical signs of selenosis include the characteristic "garlic odor" of excess selenium excretion in the breath and urine, thickened and brittle nails, hair and nail loss, lowered hemoglobin levels, mottled teeth, skin lesions, and central nervous system (CNS) abnormalities (peripheral anesthesia, acroparesthesia, and pain in the extremities …. "(64 FR 58666 at 58685)

[18] In discussing this issue, EPA (1999a) noted that "…copper, which is an essential nutrient, at high doses can cause vascular injury and hemolytic anemia. It should also be noted that copper exhibits high acute and chronic toxicity to aquatic organisms that results in death of the organism…" (64 FR 58666 at 58685)

5: Is it appropriate to use the Waste Minimization Prioritization Tool to evaluate metals?

The list of Candidate PBT chemicals included four metals – cadmium, lead, mercury, and vanadium. Several commentors expressed the opinion that it was inappropriate to use the WMPT to identify and rank metals. For example:

…the list of PBT Candidate Chemicals to be screened and prioritized under the program includes four metals – cadmium, lead, mercury, and vanadium. Mercury is a special case because it can be readily methylated in the environment, transforming into an organometallic compound, methylmercury, that exhibits the characteristics of organic PBT compounds. But the other three metals should not be identified as PBT chemicals. As a scientific matter, it is not appropriate to evaluate (and rank) the potential hazards of metals and inorganic metal compounds using the PBT methodology and criteria that were applied by EPA in the September 1998 WMPT. … (King, p. 2)

The issue of how the WMPT model treats metals in the ranking is also of concern to us. The classification of metals as PBTs is currently being reevaluated by EPA and we believe that Ecology should reconsider ranking metals until this work is complete and available for review. (Nelson, p. 3)

…the PBT approach was developed to evaluate synthetic organic chemicals by allowing scientists and policymakers to derive simplifying assumptions to evaluate the hazards of those chemicals. Metals and inorganic metal compounds possess properties that are fundamentally different from those of organics and render the PBT methodology ineffective for assessing the hazard of metals (Luxton and Walsh, p. 1)

Based on a review of comments on this issue, there appear to be three main reasons why people believe it is inappropriate to use the WMPT to identify and rank metals. First, as discussed above, several commentors emphasized the need to consider bioavailability when evaluating metals. For example:

Metals present a special case. Species of metal compounds react very differently in terms of their bioaccumulative potential and toxicity. Some metal species, in fact, are considered nutrients which other species of the same metal may be harmful. If an elemental metal or category of metals meets the PBT criteria, then its individual or at least most common species should be further screened for bioavailability. If a specific metal compound is not determined to be bioavailable, then it should be excluded from the list and further consideration as a PBT since exposure potential will not be an issue. Therefore, any metals included on the RCRA PBT List should meet all three criteria for persistence, bioaccumulation, and toxicity, and be demonstrated to be bioavailable. (Perelman, Allen-Kellogg and Shipley, pp. 9-10)

…All metals, including lead, cadmium, and vanadium, are naturally occurring elements of the earth's crust and do not degrade. This inability to degrade is not indicative of metals' potential to pose a hazard to human health or the environment. Thus, persistence is meaningless as a screening device to determine hazard for metals. Unless a metal is bioavailable, access to any

toxic potential it may have for humans or the environment is blocked.[19] *Thus, no matter how long the metal persists in this state, it poses little or no risk to human health or the environment. It is inappropriate to classify a substance as hazardous by using an immutable characteristic of the element which has no environmental consequence. Further evidence of this criterion's inappropriateness for metals is demonstrated in the fact that all metals receive the same maximum score of 3, indicating that WMPT has no power to discriminate among candidate metals. Thus, the "persistence" characteristic is not useful to prioritize the relative hazards of substances, which was the reason why it was selected. (Luxton and Walsh, p.1-2)*

Second, several commentors argued that it was inappropriate to use the WMPT to evaluate metals because the model failed to consider differences in toxicity and persistence among various metal species. For example:

The cadmium industry has and will cooperate with efforts such as those by the Washington State Department of Ecology to reduce emissions of unacceptably high levels of harmful forms of cadmium. However, the utilization of the PBT concept as a blanket condemnation for all forms and concentrations of cadmium is scientifically indefensible. The potential harmful effects of inorganic metallic elements on human health and environment have to be evaluated and prioritized by systems other than the U.S. EPA's WMPT. (Morrow, p. 2)

…..The toxicity of metals may range depending on the different metal species and complexes and their related bioavailability. "The toxicity of metals is greatly affected by water chemistry and in particular by the natural dissolved organic carbon present in the form of humic and fulvic acids. The same cannot be said for synthetic organic chemicals."[20] *Thus, the WMPT algorithm's assignment of a single toxicity value to a metal that is predominant in a non-toxic form will overstate the potential hazard arising from the metal. (Luxton and Walsh, p. 3)*

Third, several commentors stated that it is generally accepted that metals do not biomagnify and, consequently, do not meet the general criteria for inclusion on the PBT Working List. For example:

….EPA has recognized that most metals "do not bioaccumulate appreciably" and would not meet any reasonable criterion for bioaccumulation.[21] *In fact, in EPA's final Great Lakes Water Quality Guidance document, EPA evaluated the bioaccumulation characteristics of ten metals, including lead and cadmium, and did not identify them as "bioaccumulative chemicals of concern".*[22] *The use of bioaccumulation as a predictor of hazard for metals is further problematic because "the uptake of metals by organisms will vary as a function of metal essentiality, the nutritional requirements of individual organisms, the geochemical parameters of a given environment, and the characteristics of a given species or genera of organisms"*[23] *Thus, the*

[19] P. Chapman et al., International Harmonization Related to Persistence and Bioavailability, 2 Hum. And Ecol. Risk Assessment 393-404 (1996)
[20] C.M. Lee and H.A. Allen, The Ecological Risk Assessment of Copper Differs from that of Hydrophobic Chemicals, 4 Hum. And Ecol. Risk Assessment 605-17 (1998).
[21] See Chemical Ranking Report for the RCRA PBT List Docket, Final Report, at 10 (Sept. 30, 1998)
[22] 60 Fed. Reg. 1535, 15393 (Mar. 23, 1995)
[23] Report of the Technical Workshop on Biodegradation/Persistence and Bioaccumulation/Biomagnification of Metals and Metals Compounds, Canada/European Union Metals and Minerals Working Group, Brussels, Belgium, Dec. 11-13, 1995 at 6 (Apr. 1996).

"bioaccumulation of inorganic metals compounds is not a useful parameter for their hazard identification."[24]

As you noted in your presentation at the recent workshop on Persistent, Bioaccumulative, and Toxic Chemicals sponsored by Water Environment Research Foundation and SETAC, the purpose of Ecology's PBT Strategy is to regulate those chemicals that biomagnify from "very low concentrations" in lower trophic organisms to "increasing concentrations" in humans.[25] *It is generally accepted that metals, such as lead, cadmium, and vanadium, do not biomagnify.*[26] *Given the stated boundary for application of the program, Ecology should exclude metals from the PBT strategy. (Luxton and Walsh, p.2)*

Ecology's review and analysis of public comments on Issue 5

Ecology has reviewed the comments on this issue and agrees that, at this time, the Waste Minimization Prioritization Tool (WMPT) is not an appropriate tool for evaluating metals. Ecology understands that EPA is presently working with the Science Advisory Board to develop an agency-wide approach for evaluating metals. However, as discussed above (Issue 3), Ecology believes that the technical information compiled in the WMPT support documents (along with other available technical information) provides a solid foundation for evaluating the persistence, bioaccumulation, and toxicological properties of individual metals using criteria similar to those used by other national and international organizations.

6: Is Ecology's proposal consistent with other approaches and programs?

Several commentors expressed the opinion that Ecology's proposal (particularly the proposed use of the WMPT model) is not consistent with other federal and international programs. For example:

The use of the WMPT model is also not consistent with the most recent international agreement related to PBTs as contained in the Stockholm Treaty on Persistent Organic Pollutants, scheduled to be signed in May of this year. (Nelson, p. 3)

…In effect, this notice proposes to define a PBT based on either persistence and toxicity or bioaccumulation and toxicity, rather than persistence and bioaccumulation and toxicity. Such a change departs markedly from EPA's earlier statements concerning the Waste Minimization National Plan as well as documents currently available from the Agency all of which use the term, "persistent, bioaccumulative, and toxic chemicals in hazardous waste" (emphasis added). Defining PBT to include PTs and BTs as well as PBTs contradicts the inherent logic of the term as well as the commonly accepted and understood definition of "PBT." It will also seriously mislead state and local governments and the public. (Perelman, Allen-Kellogg and Shipley, p. 2-3)

[24] Id. at x.
[25] Mike Gallagher, Washington Department of Ecology, Section XIV: Regulatory Developments in the State of Washington: An Indication of Future Trends in State Regulations for PBTs, Slide No. 6 (Mar. 15, 2001)
[26] See e.g., B.C. Suedel et al., Trophic Transfer and Biomagnification Potential of Contaminants in Aquatic Ecosystems, 136 Rev. Environ. Contam. Toxicol. 22-89 (1994).

EPA's final rule establishing water quality guidelines for the Great Lakes System examined the issue of bioavailability for ten metals, including lead, cadmium and chromium, and found none to be bioaccumulative. (60 FR 15365, 15393 (March 23, 1995)…(King, p.3)

Ecology's review and analysis of public comments on Issue 6

Ecology has reviewed the comments on this issue and the various approaches used by the other federal and international programs. Based on that review, it appears that programs have been developed for a wide range of purposes using a several different sets of evaluation criteria. Given the variety of program goals, methods and criteria, Ecology concluded that it would be extremely difficult (if not impossible) to achieve absolute consistency with every single one of these other approaches. However, Ecology has made an effort to promote consistency and believes that the approach used to develop the PBT Working List is generally consistent with approaches being used by EPA and various international organizations. Specifically:

- *Range of Chemicals:* The range of chemicals being considered by Ecology is similar to the range of PBT chemicals being considered by other programs and agencies. As shown in Table 1, the vast majority of chemicals included on the PBT Working List have been identified as PBT chemicals by one or more other organizations.

- *General Framework:* The general framework being used by Ecology to identify PBT chemicals is similar to those being used by other programs and agencies. Specifically, Ecology has chosen to focus on chemicals that are persistent, bioaccumulative, and toxic. This is consistent with all of the other federal and international programs reviewed by Ecology (see Table 2).

- *Criteria for Identifying PBT Chemicals:* As shown in Table 2, the criteria used to develop the PBT Working List are generally similar to the criteria used by other programs to evaluate persistence, bioaccumulation, and toxicity. One notable exception is the Stockholm Convention on Persistent Organic Pollutants (UNEP, 2001). The UNEP has established more restrictive criteria (e.g., longer environmental half lives, higher bioaccumulation factors) to identify chemicals whose uses will be eliminated or severely restricted than those used by Ecology to develop the PBT Working List. However, Ecology believes that the two programs differ in terms of geographic focus (global[27] vs Washington state) and purposes[28].

- *Scientific Information:* Ecology has used the information included in the WMPT to determine whether a particular chemical should be included on the PBT Working List. As noted by several commentors, there are considerable uncertainties and gaps in the available scientific information. However, in most cases, the same information has been used by other agencies and organizations to evaluate the persistence, bioaccumulation potential, and toxicity of individual chemicals.

[27] To be subject to the UNEP negotiations a substance must pose risks to populations and nations that are distant from release sites (it is not sufficient for a substance to pose risks within a nation or region).

[28] Ecology agrees with EPA (1999a) that when comparing criteria used by other organizations to identify PBT chemicals it is important to consider both the listing criteria and how the particular organization intends to use the resulting list of PBT chemicals. The criteria selected by United Nations Environmental Program are being used to identify organic pollutants whose uses will be eliminated or severely restricted. In contrast, the PBT Working List is designed to identify chemicals that (1) warrant preparation of a chemical action plan to identify ways to reduce uses and releases, (2) are a priority for voluntary reduction measures and (3) are a priority for information collection and public education.

Table 1
Ecology PBT Working List

Aldrin/Dieldrin [2, 3, 4, 5, 6]
Cadmium[1, 2, 3]
Chlordane[2, 3, 4, 5, 6]
DDT/DDD/DDE[2, 3, 4, 5, 6]
Dicofol
Dioxins and furans[3, 4, 5, 6]
Endosulfan[1, 2]
Heptachlor epoxide[1, 2, 3, 4, 5, 6]
Hexachlorobenzene[1, 2, 3, 4, 5, 6]
Hexachlorobutadiene[1]
Hexachlorocyclohexane (gamma) [1, 2, 4,
Lead[1, 3, 4]
Methoxychlor[1, 5]
Mercury[1, 2, 3, 4, 5]
Pendimethalin[5]
Pentabromo diphenyl ether
Pentachlorobenzene[1, 3, 5] /Pentachloronitrobenzene[1]
Polyaromatic hydrocarbons (PAHs) [1, 2, 3, 4, 5]
Polychlorinated biphenyls (PCBs) [2 3, 4, 5, 6]
Toxaphene[2, 3, 4, 5, 6]
Trifluralin[1, 2, 5]
1,2,4,5-Tetrachlorobenzene[1, 3]

Legend

1. Waste Minimization Priority Chemical (EPA, 1998d)
2. Ontario List (OME, 1993)
3. Bi-National Toxics Strategy Level I or II Substance (EPA, 1997)
4. EPA PBT List (EPA, 1998a)
5. Toxics Release Inventory (TRI) PBT chemical (EPA, 1999a)
6. Persistent Organic Pollutant (POP) (UNEP, 2001)

Table 2 Summary of Criteria Used by Other Organizations to Identify PBT Chemicals				
Agreement/Organization	**Persistence**	**Bioaccumulation**	**Toxicity**	**Listed Pollutants**
Criteria used to identify candidates for bans, phaseouts, or reductions (OME, 1993)	Half life > 2 days air; 6 months water or soil; or 1 year sediment.	BAF/BCF > 5000 or LogKow > 5	Acute and chronic (including toxicity of breakdown products)	27 pollutants
Environment Canada (1994) – Accelerated Reduction/ Elimination of Toxics (ARET)	Environmental half life > 50 days.	BCF > 500 (Substances with BCF between 250 and 500 flagged for data collection)	Evaluation to produce normalized toxicity score (NTS). NTS > 40 (Max=60)	16 substances or groups of substances.
EPA – Water Quality Criteria (1995)	Half life in water, sediment or biota > 56 days	BAF > 1000	Potential to cause adverse effects.	16 substances or groups of substances.
Great Lakes Bi-National Toxics Strategy (GLNPO, 1997)	Half life > 56 days (high), 7-56 days (moderate) and < 7 days (low)	BAF > 5000 (high); 1000 – 5000 (moderate); and < 1000 (low)	Substances that appear on one or more existing toxic substance lists.	12 Level I substances and 14 Level II substances.
North American Commission on Environmental Cooperation (1997)	Half life > 2 days air; 6 months water or soil; or 1 year sediment.	BAF/BCF > 5000 or LogKow > 5	Acute and chronic (including toxicity of breakdown products)	
EPA – National PBT Strategy (EPA, 1998a)	Half life > 56 days (high), 7-56 days (moderate) and < 7 days (low)	BAF > 5000 (high); 1000 – 5000 (moderate); and < 1000 (low)	Substances that appear on one or more existing toxic substance lists.	12 Level I substances identified by the Great Lakes National Program Office
EPA – Waste Minimization Program (1998b)	Regional half life > 580 hrs (high); 140 – 580 hrs (medium); and < 140 days (low)	BAF/BCF > 1000 (high); 250 – 1000 (medium); and < 250 (low)	Potential to cause cancer, non-cancer and ecological effects.	53 pollutants
EPA – Toxics Release Inventory (EPA, 1999a)	Half life in water, sediment, soil > 2 months; air > 5 days	BAF/BCF > 1000	Chemicals on Great Lakes Level I List or receiving high WMPT scores.	19 substances
EPA – Office of Pollution Prevention and Toxics (EPA, 1999b)	Half life in water, sediment, soil > 2 months; air > 5 days	BAF/BCF > 1000	New or existing chemicals undergoing review under the Toxics Substances Control Act.	
United Nations Environmental Programs/ Persistent Organic Pollutants (UNEP, 2001)	Half life > (2 or 6) mths in water; 6 mths in soil/ sediment or other evidence that substance is sufficiently persistent to be of concern.	BAF/BCF > 5000 or Log Kow > 4 or 5; evidence that substance with lower BCF /BAF is of concern or monitoring indicates concern.	Chronic toxicity or ecotoxicity data indicate a potential for damage human health or the environment due to long-range transport.	11 chemicals and chemical groups
Ecology PBT Working List	**Regional half life > 580 hrs**	**BAF/BCF > 1000**	**Potential to cause cancer, non-cancer and ecological effects**	**22 chemicals or chemical groups**

7: Has Ecology provided the public with an adequate opportunity to review and provide comments on the PBT Working List?

Several individuals and organizations expressed the opinion that Ecology had provided an inadequate amount of public notice and opportunities for public comment. For example:

Additionally, a proposed strategy such as this, which could impact interstate commerce, should not be published exclusively on the internet. It is not possible for the CPMA and hundreds of other impacted associations and companies to search continually the websites even of the EPA, apart from the myriad of individual websites set up by state and local governments. We have only become aware of this important Proposed Strategy in the previous twenty four hours. Given the time constraints, we are not able to provide further comment. Strategies should first be developed to notify and obtain comments from impacted industries…. It is our recommendation that the Proposed Strategy should be withdrawn until a reasonable means of identifying PBTs and assessing metals can be determined by the EPA and international agencies. At a minimum, the Proposed Strategy should be re-proposed with much broader publication and a reasonable time for the impacted entities to research and prepare comments. (Robinson, p. 2)

Several individuals and organizations recommended that Ecology conduct a stakeholder process prior to finalizing an approach for identifying and ranking PBT chemicals. For example:

These concerns, and many other questions that could be asked, may be the result of inadequate understanding of how the proposal would work, or they may raise issues that need to be resolved before moving ahead. In either case, there is a significant need for further explanation and discussion before the approach to setting priorities will find acceptance….

It is therefore recommended that a stakeholder process be established before a prioritization method is established or implemented. This would provide interested parties the opportunity to learn more details of the Ecology proposal, including specific examples; to provide information and recommendations; to serve as a sounding board for ideas; and to actively participate in the development of an Approach to Screen and Prioritize PBTs in Washington State. (Riley, p. 2)

AWB believes that Ecology should first initiate a stakeholder process to review the proposed ranking and prioritization process, particularly in light of the proposal to re-rank the PBT Strategy list of chemicals by the end of this year. The information provided in Appendix E regarding the proposed ranking/prioritization process is insufficient for anyone to evaluate the effects of the proposal. Some of the specific inadequacies are discussed below, including a lack of sufficient information on how the process would work as a practical matter. Ecology needs to provide some examples of how the process would be applied to a chemical and it is also not clear how the public policy considerations would be included. (Nelson, p. 3)

Over the last three years, Ecology has provided three opportunities for public review and comment on three different approaches for identifying PBT chemicals. Ecology has also periodically briefed stakeholder groups on the status and issues associated with preparing the proposed list. In addition, Ecology has discussed particular issues with knowledgeable individuals outside the agency.

Within that context, Ecology acknowledges that the January 2001 proposal does not contain detailed chemical-specific information that would enable an individual or organization to determine how a particular chemical would be scored and ranked. Ecology also agrees that such information is critical to understanding and evaluating the significance of a final proposal.

However, the Department believes that the comments on this issue are somewhat misleading in that the January 2001 proposal was not a final proposal. It was essentially a scoping notice designed to elicit comments on the general framework for identifying and ranking PBT chemicals. Ecology has reviewed the many comments received on the January 2001 proposal and (as discussed in other sections of this document) taken those comments into account when preparing a revised listing and ranking framework. The revised framework has been used (in combination with chemical-specific information) to prepare the PBT Working List.

The draft PBT Working List is being distributed for public comment. The supporting documentation includes the chemical-specific information used to construct the list. Ecology encourages individuals and organizations to review this information if they are concerned about the presence or absence of particular chemicals on the PBT Working List. Ecology believes that the December 31, 2002 deadline for public comment will provide sufficient time to review the list and supporting documentation.

8: Will the PBT Working List create unreasonable impacts?

Many organizations and individuals expressed concerns about the potential economic impacts associated with the PBT Strategy (in general) and the PBT Working List (specifically). Some commentors highlighted concerns about direct impacts on trade and economy that might result when actions are taken to reduce the use of chemicals appearing on the PBT Working List. For example:

…..We do not support restrictions in Washington State which, in turn, create barriers to interstate and international trade. We believe strongly that these issues should be addressed at the national level, and where applicable at the international level. (Robinson, p. 2)

Some of these individuals and organizations also highlighted the potential for indirect impacts caused by including specific chemicals on the PBT Working List. One commentor provided an example of such indirect impacts:

EPA must recognize that environmental organizations and state and local agencies are likely to use the RCRA PBT List as a convenient list of chemicals to target for regulatory or other control efforts. For example, the Environmental Defense Fund used results from the draft WMPT in

their scorecard website. EPA has an obligation as a steward of information to ensure that the WMPT information and RCRA PBT List are accurate, lest errors be magnified through use by other entities….. (Price et al., p.11)

Ecology's review and analysis of public comments on Issue 8

Ecology believes there are three key points associated with responding to the issues and concerns raised by these comments. These include:

- *There are no immediate direct economic impacts associated with including a substance on the PBT Working List.* The PBT Working List is an administrative tool to help guide agency choices on actions and priorities. Unlike other chemical lists, there are no immediate actions that flow directly from the listing process.

- *Economic impacts will be explicitly considered when implementing the PBT Strategy.* Ecology believes many of the comments on this issue reflect a general misunderstanding on how factors such as cost, technical feasibility, and net environmental impacts will be considered when making decisions on individual chemicals, sources and/or uses. There are several main reasons why such factors must be considered:

- *Consideration of economic impacts and other factors is required in order to devise solutions that can actually be implemented by individuals and organizations.* Once a substance has been identified as a PBT, a full range of responses are possible. Options include control, prevention, use reduction and phase-out. Consistent with many current environmental laws, application of the precautionary principle creates a preference for the use of safer alternatives, in this case, prevention. However, that presumption can be overcome based on consideration of the technical, economic, and social circumstances surrounding the specific activity.

- *Consideration of economic impacts and other factors is required by the current laws and regulations that may form the basis for state requirements.* Most environmental laws require that agencies consider costs, technical feasibility, and net environmental impacts when establishing requirements to limit uses, prevent releases and/or cleanup existing contamination.

- *Consideration of multiple factors is consistent with implementation of the precautionary principle by other organizations.* Most discussions of precautionary principle center on the concept of taking actions to reduce potential hazards before there is strong proof of harm. However, as described by the European Environment Agency[29], the principle actually includes several elements that recognize the role play by other factors when deciding how the principle might be applied to reducing PBT chemicals. These include:

  - *Research and monitoring for the early detection of hazards;*
  - *A general reduction of environmental burdens;*
  - *The promotion of 'clean production' and innovation;*

[29] European Environment Agency. 2001. Late lessons from early warnings: The precautionary principle 1896-2000. EEA, Copenhagen, Denmark.

- *The proportionality principle, where the costs of actions to prevent hazards should not be disproportionate to the likely benefits;*
- *A cooperative approach between stakeholders to solving problems via integrated policy measures that aim to improve the environment, competitiveness and employment;*
- *Action to reduce risks before full 'proof' of harm is available if impacts could be serious or irreversible.*

Ecology recognizes the potential for indirect impacts associated with the PBT Working List and intends to work with the regulated community to identify ways to minimize unintended impacts. Some of these indirect impacts (e.g., voluntary choices by consumers to use non-PBT alternatives) are intended outcomes. However, other indirect impacts may be counterproductive. During the public comment period, Ecology intends to engage groups and individuals concerned about this issue and seek ways to avoid the latter types of indirect effects that might arise from publishing the PBT Working List.

III. Summary of Comments Related to Preparing the PBT Working List and Ecology's Responses

9: What criteria should Ecology use to prepare the PBT Working List?

In January 2001, Ecology proposed to use the WMPT to identify candidates for potential inclusion on the Washington PBT list. These "Candidate Chemicals" would then be evaluated further to determine whether they should actually be included on the Washington PBT List (PBT Working List). Under the January 2001 proposal, a chemical had to receive score of at least 2 (out of a possible 3) for each of the "persistence (P)", "bioaccumulation (B)" and "toxicity (T)" characteristics and had to have a total score of at least 7 out of a possible 9 in order to be included on the Candidate List. Ecology proposed to include a candidate chemical on the Washington PBT List if it had been detected in one of several environmental media and/or reported as being released from Washington sources.

Ecology received numerous comments on the proposed approach for identifying PBT chemicals. First, some individuals and organizations requested that Ecology provide a better explanation on why it was proposing include chemicals with PBT scores of 7, 8, or 9. For example:

Ecology fails to explain why it is proposing to first screen for chemicals which elicit a score of 7, 8 or 9 with at least a score of 2 for each of the three categories. What is the significance of this ranking relative to the lower rankings. Ecology also does not tell us how each chemical ranked in each of the three categories. This information is essential to understanding the proposed ranking system. (Nelson, pp. 2-3)

The majority of individuals and organizations expressed concerns that use of the proposed approach would result a list that included too many chemicals. Three main lines of reasoning were used to support in this position. First, some commentors expressed the opinion that the proposed criteria for identifying PBT chemicals were inconsistent with federal and international approaches (See Issues 2, 3 and 6). In addition, one commentor stated that Ecology's proposal to include chemicals with a total PBT score of 7 was inconsistent with EPA's current approach for using the results of the WMPT:

….We also understand that EPA has decided to raise the threshold for identifying PBT chemicals under the WMPT methodology from a total score of 7 to a total score of 8. Thus, by relying on EPA's September WMPT (and the associated chemical scores and rankings), the Department would be using criteria and results that EPA itself no longer endorses. (King, p. 2)

Second, several individuals and organizations expressed the opinion that the WMPT model is technically flawed and would result in the misclassification of many chemicals as PBT chemicals. (See Issues 3 and 5)

Third, several commentors expressed concerns that by including chemicals with PBT scores of 7, 8 and 9, Ecology would include some chemicals that do not display all three characteristics (i.e., persistence, bioaccumulation, and toxicity). For example:

Expanding the list beyond the chemicals that meet the three-part PBT criteria will not make the resulting program more effective or more protective. Rather, it will diffuse resources away from those highest priority chemicals. It also adds to the difficulty and ambiguity of tracking and reporting progress under a waste minimization program….. PBTs are not a generic list of any and all chemicals that the Agency, for whatever reason, has concerns. Therefore CMA strongly urges the Agency, including the Office of Solid Waste, to label a chemical "PBT" only if it exhibits all three characteristics. (Perelman, Allen-Kellogg and Shipley, pp. 2-3 – Attachment to Comments from Howlett and Rampy)

Several individuals and organizations provided recommendations on criteria for identifying chemicals to include on the PBT Working List. First, one commentor recommended that Ecology use the criteria developed by various international organizations:

Ecology is keenly aware of the appropriate criteria it should be using in order to expand the list of PBT chemicals under the Ecology strategy. They are the same criteria that have been adopted in numerous global and regional protocols and conventions, including the United Nations Environmental Policy's ("UNEP") Stockholm Convention on Persistent Organic Pollutants ("POPs"), the UN Economic Commission for Europe ("UNECE") Aarhus Protocol on POPs, and the North American Commission for Environmental Cooperation ("NACEC") Process for Identifying Substances for Regional Action. Indeed, Ecology has recognized the legitimacy of those internationally-recognized criteria by limiting the initial focus of its PBT Policy to nine (9) of the list of twelve (12) chemicals that have been targeted under the international/regional programs. Moreover, each of the above-listed protocols and conventions include a detailed and comprehensive mechanism for identifying PBTs beyond the dirty dozen. That mechanism has been carefully hammered out by consensus after hard-fought negotiation and both the U.S. EPA and the State Department played an instrumental role in the process. WWPI believes it is premature for Ecology now to consider adding additional substances to its PBT strategy. However, to the extent Ecology insists on doing so, we urge it to use the internationally-recognized mechanisms for identifying additional PBT chemicals. (Hayward, pp. 2-3)

One commentor included recommendations on identifying PBT chemicals that were provided to the Environmental Protection Agency in early 1999 by the Chemical Manufacturers Association (CMA). The CMA recommended that EPA focus on chemicals that had received PBT scores of nine (9):

If the fencelines for persistence and bioaccumulation are adjusted as describe above, then the WMPT Screen should be adjusted to include chemicals which have any of the WMPT scores of:

Total 9 = 3(P) + 3(B) + 3 (T for either human health or ecological concerns)
Total 8 = 3(P) + 2(B) + 3 (T for either human health or ecological concerns)
Total 8 = 2(P) + 3(B) + 3 (T for either human health or ecological concerns)

…. If the persistence and bioaccumulation fencelines are not adjusted, then only chemicals scoring 9 = 3(P) + 3(B) + 3(T for human health or ecological concerns) should be considered PBTs. ….. (Perelman, Allen-Kellogg and Shipley, p. 14 – Attachment to Comments from Howlett and Rampy)

Although the majority of comments on the January 2001 proposal reflected concerns about including too many chemicals on the PBT Working List, several organizations expressed concerns that Ecology's proposed approach was too restrictive[30]. They recommended that the Department also consider persistent and toxic substances (PTs) and bioaccumulative and toxic substances (BTs). For example:

We believe Ecology should include toxic chemicals that are persistent OR bioaccumulative (as opposed to persistent AND bioaccumulative) and that the scoring procedure should be modified to reflect this. A chemical that is highly toxic (2 or 3) and either bioaccumulative or persistent should be put on the candidate list. (Rice and Dickey, p. 1)

Many of these organizations also expressed the opinion that it was inappropriate to consider factors other than PBT characteristics when preparing the PBT Working List. For example:

….chemicals should be added to the PBT list solely on the basis of the PBT values. Does the chemical persist or bioaccumulate and is it toxic? These are the questions, which should be used to add to the list. The agency may use other factors to determine which chemicals should be acted on first in terms of reduction and elimination, but the PBT list should be a complete list of PBT chemicals. This is the only way to ensure that chemicals can be added to the list in a timely manner before contamination builds up to dangerous levels in the environment. Also, it is important to generate a "clean" PBT list based on persistence, bioaccumulation and toxicity factors because if presence is made part of the screening criteria and a given chemical does not appear on the list, it will be difficult for the public to know whether the chemical is not actually a PBT or if its not on the list because it has not been found in Washington. (Rice and Dickey, p. 1)

Ecology's review and analysis of public comments on Issue 9

Ecology has reviewed the comments on this issue and believes that they raise a number of important issues regarding the approach for identifying chemicals for inclusion on the PBT Working List. Ecology continues to believe that decisions on what chemicals to include on the Washington list should be based on an evaluation of a chemical's PBT characteristics and evidence that the chemical poses a problem in Washington. However, after reviewing the public comments on this issue, Ecology believes that the interpretation of this information should be tempered by consideration of approaches being used by EPA and various international organizations to identify PBT chemicals. Consequently, Ecology decided to modify the criteria and approach for identifying PBT chemicals described in the proposed strategy submitted to the Washington Legislature in January 2001. Specifically, Ecology has used the following criteria to identify the 22 chemicals and chemical groups that are included on the PBT Working List:

[30] As discussed under Issue 2, several organizations and thousands of individuals criticized the draft strategy distributed in August 2000 as being too narrowly focused. They recommended that Ecology include the 27 chemicals identified by the Province of Ontario on the initial Washington list.

- *Persistence:* Persistence indicates how long a chemical is expected to exist in the environment and be available for exposure. The primary measure used to evaluate persistence is the chemical's regional half-life estimated using a multi-media partitioning model included in the revised WMPT (EPA, 1998b). In order to be included on the PBT Working List, a chemical must have a regional half-life greater than 580 hours. Comments associated with the criteria for evaluating persistence are discussed under Issue 10.

- *Bioaccumulation Potential:* Bioaccumulation potential is defined as "… the capacity of a chemical to increase in concentration or accumulate (be stored in tissue) in an organism as a result of uptake from all environmental sources over a period of time." (EPA, 1998b). Two types of chemical-specific measures have been used to evaluate a chemical's potential to bioaccumulate: (1) measured or predicted bioaccumulation factors (BAFs) and (2) measured or predicted bioconcentration factors (BCFs). In order to be included on the PBT Working List, a chemical must have a BAF/BCF greater than 1000. Comments associated with the criteria for evaluating bioaccumulation potential are discussed under Issue 11.

- *Toxicity:* Toxicity refers to a chemical's potential to cause adverse effects on human health and/or the environment. EPA (1998c) reviewed available information and assigned scores for three toxicity measures (Ecological Toxicity, Human Health (Non-Cancer Effects) and Human Health (Cancer Effects). In order to be included on the PBT Working List, a chemical must have a toxicity score of 3 (high concern) for at least one of these three measures. Comments associated with the criteria for evaluating toxicity are discussed under Issues 12 - 14.

- *Use, Release, or Environmental Presence:* In order to be included on the PBT Working List, there must be some basis to conclude that a chemical has been or is currently being used in Washington, released by Washington sources or present in Washington's environment. As discussed under Issue 15, this is a screening evaluation based on a review of readily available information on the use, release, and environmental presence of chemicals meeting the persistence, bioaccumulation, and toxicity criteria. In making this determination, Ecology primarily relied upon environmental and source data that was readily available in early 2001. (SAIC, 2001) This was supplemented with information on individual chemicals from other sources.

In addition, Ecology decided to revise the evaluation process for applying these criteria. The modified approach includes the following steps:

- *Identification of Candidate Chemicals:* Ecology identified 66 candidate chemicals and chemical groups in the January 2001 proposal. The candidate list included substances that have PBT characteristic scores of seven (7), eight (8) or nine (9). In response to public comments, Ecology decided to add four chemicals to the candidate list (endrin, mirex, octachlorostyrene, and pentabromo diphenyl ether). These four chemicals appear on other PBT list and/or received a PBT score of 9. Issues associated with each these chemicals are discussed in Sections IV and V.

- *Group Candidate Chemicals with Common Characteristics:* The candidate list included several groups of chemicals (e.g., PCBs, dioxins/furans). For purposes of creating the PBT Working List, Ecology combined several other candidate chemicals sharing common

characteristics into additional chemical groups. These include: (1) the four high molecular weight polynuclear aromatic hydrocarbons (PAH) were combined into a single group identified as PAH compounds; (2) the alpha- and beta- forms of endosulfan were combined into a single endosulfan group; and (3) the alpha-, beta- and delta- forms of hexachlorocyclohexane were combined into a hexachlorocyclohexane group.

- *Screen Candidate Chemicals Based on PBT Characteristics Score:* As summarized above, Ecology decided to modify the criteria for identifying PBT chemicals in order to improve the consistency between the criteria used to develop the PBT Working List and the criteria being used by other federal and international organizations to identify PBT chemicals. Issues associated with the modified criteria are discussed in greater detail under Issues 6 and 10 - 14. In general, Ecology relied upon the scientific and technical information compiled by EPA and included in the WMPT Support Document (EPA, 1998b) to judge whether an individual chemical met the criteria for inclusion on the PBT Working List. Ecology also considered information developed subsequent to 1998 when evaluating the persistence, bioaccumulation, or toxicity of individual chemicals. This includes information provided by individuals and organizations as part of their comments on the proposed approach.

- *Screen Remaining Candidate Chemicals Based on Environmental Presence and/or Source Releases:* Ecology compiled available information on the use, release, or environmental presence of the remaining candidate chemicals. This information was reviewed in order to determine whether there was a reasonable basis to suspect that a chemical or chemical group might pose a problem in Washington State.

Ecology has used this revised process to identify the 22 chemicals or chemical groups included on the PBT Working List. The Department believes that the list is based on current scientific information and is consistent with federal and international efforts to address these types of chemicals. The information used to evaluate each chemical is summarized in Section IV.

Within this framework, Ecology believes it is important to distinguish between the "candidate list" and the PBT Working List. First, the purpose of the candidate list was to identify the universe of chemicals that Ecology planned to consider for inclusion on the PBT Working List. Ecology included chemicals with PBT scores of 7, 8, and 9 to maintain consistency with the approach used by EPA in identifying PBT chemicals under the National Waste Minimization Program and take into account the variability and uncertainties associated with "P", "B", and "T" scores developed by EPA. Second, Ecology did not intend to include all of the chemicals appearing on the candidate list on the PBT Working List. As discussed above, Ecology has used a criteria-based approach to prepare the PBT Working List.

10: What criteria should Ecology use to evaluate environmental persistence?

In January 2001, Ecology proposed to use the persistence, bioaccumulation, and toxicity scores published in the September 1998 version of the WMPT to characterize the persistence, bioaccumulation potential, and toxicity of individual chemicals or chemical groups. With

respect to persistence, EPA used a steady-state, non-equilibrium multimedia partitioning model[31] to estimate a regional half-life for each chemical. Persistence scores were then assigned using the following scoring fencelines[32]: regional half life > 580 hours received a "P" score of 3; regional half life of 140 to 580 hours received a "P" score of 2; and regional half life < 140 hours received a "P" score of 1. EPA assigned elemental metals a persistence score of 3.

Ecology received a broad range of comments on this issue that can be divided into four broad areas[33]. First, one commentor expressed the opinion that environmental persistence does not represent a characteristic that is useful for determining whether a chemical (particularly metals) poses a threat to human health and the environment.

The use of persistence and benign persistence, in particular, as major factors in the scoring procedure skews the analysis and creates an unwarranted assumption of risk which is not justified in practice. Persistence as a defining characteristic does not itself define a substance as harmful to humans or the environment. (Robinson, p. 2)

Second, one commentor included recommendations and comments submitted to the Environmental Protection Agency in early 1999 by the Chemical Manufacturers Association. In those comments, the CMA expressed support for EPA decision to use a multi-media model to estimate regional half-lives:

CMA endorses the use of the EQC model for apportioning persistence among media as an improvement over the earlier version of the model. The EQC multi-media model allows for establishing the environmental media (aid water, soil, and/or sediments) into which a chemical will tend to partition. The persistence evaluation using the EQC model will first take into account the environmental media of concern and then determine the overall persistence in the environment….CMA strongly supports inclusion of the EQC multimedia model for the WMPT for assessing persistence…..(Perelman, Allen-Kellogg and Shipley, pp. 7-8 – Attachment to Comments from Howlett and Rampy)

However, Ecology received several comments expressing concerns with how the EQC model was being used to evaluate particular chemicals. For example:

The regional half-life model used by EPA to score persistence requires inputs of releases to air, water, and soil. EPA assumed that equal portions were released to each phase (1000 kg/hr to

[31] EPA used the multi-media equilibrium criterion (EQC) model to evaluate the environmental fate of chemicals. The EQC model is a steady-state non-equilibrium multi-media partitioning model developed by Donald Mackay (Mackay, 1992, 1995). Input requirements for the model include (1) measured half-life data for air, water, soil, and sediment; (2) models predicting estimated degradation times, (3) a model predicting hydrolysis half-life values for chemicals, and (4) other physical-chemical properties. Results for the model are expressed as a regional persistence residence time (regional half-life) and the estimated percent of each portion of the area modeled. For purposes of the WMPT evaluation, EPA developed an Excel spreadsheet to perform calculations equivalent to the EQC model. Specifically, the EQC model equations (which are expressed in terms of "fugacity" (i.e., escaping tendency)) were rewritten in terms of chemical concentrations.

[32] EPA established the persistence scoring fencelines by rank ordering all of the chemicals/chemical groups in terms of the estimated regional half life. The chemicals were then separated into three groups corresponding to the upper 25 percent of the chemicals, the middle 50 percent and the lower 25 percent. See EPA, 1998b.

[33] Ecology also received several comments questioning the persistence scores for individual chemicals or chemical groups. These are summarized and evaluated in Sections IV and V of this document.

each of air, water, and soil). Comparison to actual TRI data, however, shows this assumption is inappropriate for phthalates and results in an overestimation of persistence for those compounds. (Price et. al. p. 29)

Third, several commentors expressed the opinion that the statistical distribution used by EPA to assign persistence ("P") scores is unjustified and inconsistent with approaches being used by other EPA programs and international organizations. For example:

…the statistical distribution applied in the WMPT is not consistent with the criteria adopted internationally, in the North American region, or in other EPA PBT-related programs. For example, the WMPT applies a technically unjustifiable 25-50-25 percent statistical distribution for persistence which makes the WMPT approach to persistence fundamentally non-criteria-based…. (Howlett and Rampy, p. 2)

Most commentors did not explicitly identify alternative approaches for evaluating persistence that they would consider appropriate for Ecology's use in identifying PBT chemicals. However, one commentor included recommendations submitted to the Environmental Protection Agency by the Chemical Manufacturers Association in early 1999. In those comments, the CMA recommended that EPA adopt the "persistence" criteria used by various international organizations to identify PBT chemicals:

However, CMA strongly urges the EPA to adjust the persistence fencelines to reflect criteria based fencelines. The model's current fenceline setting method was based on a 1:2:1 (i.e., the upper 25% in the high score bin; the middle 50% in the medium score bin; and the lower 25% in the low score bin) statistical distribution rather than actual persistence criteria. EPA will likely use the WMPT to evaluate many additional chemicals as complete data sets become available. Therefore, utilizing a 1:2:1 distribution creates "floating fencelines" which will change as the data set increases in size. …. CMA strongly endorses persistence criteria established by international bodies cited above. Therefore, we recommend EPA set the following persistence fencelines in the WMPT:

3 = Half-Life > 6 months.
2 = Half-Life > 2 months to < 6 months.
1 = Half-Life < 2 months. (Perelman, Allen-Kellogg and Shipley, pp. 8-9 – Attachment to Comments from Howlett and Rampy)

Finally, as discussed under Issues 4 and 5, many commentors expressed the opinion that EPA's approach for evaluating the persistence of individual metals was flawed. For example:

…All metals, including lead, cadmium, and vanadium, are naturally occurring elements of the earth's crust and do not degrade. This inability to degrade is not indicative of metals' potential to pose a hazard to human health or the environment. Thus, persistence is meaningless as a screening device to determine hazard for metals. Unless a metal is bioavailable, access to any toxic potential it may have for humans or the environment is blocked.[34] Thus, no matter how long the metal persists in this state, it poses little or no risk to human health or the environment.

[34] P. Chapman et al., International Harmonization Related to Persistence and Bioavailability, 2 Hum. And Ecol. Risk Assessment 393-404 (1996)

It is inappropriate to classify a substance as hazardous by using an immutable characteristic of the element which has no environmental consequence. Further evidence of this criterion's inappropriateness for metals is demonstrated in the fact that all metals receive the same maximum score of 3, indicating that WMPT has no power to discriminate among candidate metals. Thus, the "persistence" characteristic is not useful to prioritize the relative hazards of substances, which was the reason why it was selected. (Luxton and Walsh, p.)

Ecology's review and analysis of public comments on Issue 10

Ecology continues to believe that the regional half-life values compiled by EPA generally provide a sound basis for characterizing the environmental persistence of individual chemicals and chemical groups. However, after evaluating the public comments, Ecology has decided to list only those chemicals that have regional half-life greater than 580 hours (e.g., two months).

- *Persistence as a Defining Characteristic:* Ecology continues to believe that this characteristic must be considered when evaluating PBT chemicals. Persistence is the tendency of a substance to remain in the environment without transformation or breakdown and provides an indication of how long a chemical is expected to exist in the environment and, thus, be available for exposure. However, Ecology also agrees with commentors that a chemical's persistence is a function of a number of chemical-specific and site-specific conditions. EPA (1998b) acknowledged this complexity in noting that "…estimating the persistence of chemicals in the environment is a challenging exercise, because persistence depends on basic processes such as how the chemicals are released (i.e., which environmental media they are released to initially), how they move in the environment (i.e., which environmental media they tend to partition to), and their tendency to degrade with these media (i.e., their persistence)." However, Ecology does not believe this complexity represents a valid reason not to consider this characteristic. Indeed, an approach that does not consider a chemical's persistence would be inconsistent with other federal and international approaches.

- *Use of EQC Multi-Media Model to Estimate Regional Half-Lives:* Ecology believes that spreadsheet version of the EQC multi-media model provides a technically sound approach for estimating regional half lives. The rationale for using a measure of overall environmental persistence (as opposed to media specific half live values) includes the following:

  - *Scientific Review:* The EQC multi-media model was developed by Donald Mackey (Mackey et al. 1992) and is commonly used to evaluate the environmental fate of chemicals at level 3 (steady state, non-equilibrium conditions). The modeled environment is considered to be more broadly applicable than other level 3 models (e.g., CalTOX). The model has undergone peer review and is generally accepted by academic and industry modeling experts. EPA conducted an extensive review (including consultation with outside modeling experts) before concluding that the EQC model was sufficient for purposes of performing screening level analyses. In general, the use of multi-media models is widely supported and EPA is currently working with its Science Advisory Board to develop a state of the art model for evaluating multimedia chemical fate and transport (e.g., Total Risk Integrated Model (TRIM)).

- *Program Consistency:* Many state and federal environmental programs currently use multi-media modeling to evaluate the fate and transport of hazardous substances. With respect to PBT chemicals, EPA used multi-media modeling to evaluate the persistence of individual chemicals for purposes of National Waste Minimization National Plan (EPA, 1998d). In addition, EPA (1999a) specified that multi-media modeling might be used when evaluating "persistence" of chemicals under the Toxics Release Inventory (TRI). Specifically, EPA stated that "…multimedia modeling may be used to override compartment (medium) specific degradation half lives, but only if all model inputs are judged sufficiently accurate". In other related areas, EPA has used multi-media modeling to evaluate residual risks posed by hazardous air pollutants and evaluate whether to re-register pesticides under the Food Quality Protection Act. In addition, numerous expert advisory committees (e.g., National Research Council (1994), Commission on Risk Assessment and Risk Management (CRARM, 1997)) have stressed the importance of comprehensive multi-media assessments.

- *Public comments:* The one comment received on this issue appeared to support the use of the EQC multimedia model for assessing persistence.

Ecology acknowledges that there a numerous technical (e.g., selection of default emission rates, use of average values for compartment-specific half-life) and policy (e.g., management choices associated with dealing with variability in input parameters) that influence model outputs. In general, Ecology believes that these have been appropriately addressed by EPA.

- *Criteria for Evaluating Environmental Persistence:* Ecology reviewed the comments received on this issue and has decided to modify the approach for listing PBT chemicals identified in the Ecology (2000b). Specifically, Ecology has decided to limit the initial Washington PBT List to those chemicals that have a regional half-life greater than 580 hours (Persistence score = 3). The rationale for this modified approach includes:

  - *Program Consistency:* Ecology acknowledges that scientists are not able to identify a bright line distinguishing persistent from non-persistent chemicals and that any attempt to make such distinctions is somewhat arbitrary. However, Ecology believes that using a regional half-life of 580 hours is consistent with other federal and international programs for addressing PBT chemicals.[35]

  - *Focus:* The modified approach will enable Ecology to focus on the most important PBT chemicals during the initial stages of the PBT initiative.

35 Ecology recognizes that such comparisons are complicated by the fact that most federal and international programs have established criteria for evaluating environmental persistence that are based upon media-specific half life values (e.g., half-life in sediment greater than 2 months) rather than overall environmental persistence. However, using a regional half life of 580 hours to screen chemicals appears to produce results (in terms of which chemicals are included on the PBT Working List) that are similar to those associated with the use of a media-specific half life values (e.g., 2 months in sediment or soil) similar to those used by EPA to identify PBT chemicals for purposes of the Toxics Release Inventory (EPA, 1999a) and the Pre-manufacturing Notification (PMN) Program (EPA, 1999b)

- *Evaluating the Persistence of Individual Metals:* Ecology acknowledges the difficulties associated with evaluating the fate and transport of metals in the environment. As discussed under Issues 4 and 5, EPA is currently working with the Science Advisory Board to develop an agency-wide approach for evaluating metals. The Department hopes that this process will produce a useable approach for evaluating the fate and transport of metals. However, in the meantime, the Department believes there is other information that provides a sufficient basis for including three metals (mercury, lead, and cadmium) on the PBT Working List. The rationale for including these and other chemicals on the PBT Working List are discussed in Section IV.

11: What criteria should Ecology use to evaluate bioaccumulation potential?

In January 2001, Ecology proposed to use the persistence, bioaccumulation, and toxicity scores published in the September 1998 version of the WMPT to characterize the persistence, bioaccumulation potential, and toxicity of individual chemicals. With respect to bioaccumulation, EPA collected bioaccumulation factors (BAF) and bioconcentration factors (BCFs) for several hundred chemicals and chemical groups. Bioaccumulation scores were then assigned using the following scoring fencelines: BAF/BCF > 1000 received a "B" score of 3; BAF/BCF of 250 to 1000 received a "B" score of 2; and a BAF/BCF < 250 received a "B" score of 1.

Several commentors expressed the opinion that it was inappropriate to use the WMPT approach for evaluating bioaccumulation potential. For example:

The scoring system used to evaluate bioaccumulation is flawed and fails to correctly identify and characterize whole classes of compounds. These types of substances are not bioaccumulative even thought the scoring process identifies them as such. (Robinson, p. 2)

Commentors raised three broad types of issues associated with Ecology's proposed approach. First, several commentors expressed concerns that EPA's approach was inconsistent with approaches being used by other EPA programs and international bodies. For example:

…the statistical distribution applied in the WMPT is not consistent with the criteria adopted internationally, in the North American region, or in other EPA PBT-related programs. …In contrast, every other PBT-related program adopts specific criteria for identifying PBT substances (i.e., persistence > 6 months in soil and sediment; bioaccumulation factor > 5000 (or logKow > 5)…. (Howlett and Rampy, p. 2)

Most commentors did not identify alternative approaches for evaluating bioaccumulation that they would consider appropriate for Ecology's use in identifying PBT chemicals. However, one commentor submitted (as an attachment to their written comments) comments and recommendations made to the Environmental Protection Agency by the Chemical Manufacturers Association (CMA). With respect to this issue, the CMA recommended that EPA adopt the "bioaccumulation" criteria used by various international organizations to identify PBT chemicals:

….CMA believes that EPA should establish Agency-wide criteria which are consistent with consensus in international forums. Therefore, we recommend the following WMPT fencelines for bioaccumulation evaluations:

3 = BAF or BCF > 5,000
2 = BAF or BCF > 1,000 to < 5,000
1 = BAF or BCF < 1,000

While industry has disagreed with EPA, and some in the international community have debated whether to use a BAF or BCF of 1000, there is clear agreement that substances below 1,000 present little concern for bioaccumulation. Likewise, there is little disagreement that a BAF or BCF of 5,000 should trigger additional investigation. Therefore, we recommend the compromise above. It scores as "high" (3) and "low" (1) levels with little disagreement while preserving that level of disagreement between 1,000 and 5,000 as "medium" (2). When coupled with our overall scoring recommendations described below, we believe this offers a fair and scientifically justifiable approach to score bioaccumulation. (Perelman, Allen-Kellogg and Shipley, p. 10 – Attachment to Comments from Howlett and Shipley)

Second, Ecology received several comments questioning the quality and reliability of the data used by EPA to evaluate bioaccumulation potential[36]. For example:

The WMPT was designed as a tool to screen a large number of chemicals for development of the draft RCRA PBT list. For the tool, EPA relied on a number of other databases. EPA did not double-check the chemical-specific information in those databases for reliability or updates…. (Price et al., p. 3)

Finally, one individual recommended that Ecology use the term "biomagnification" instead of the term "bioaccumulation". However, it was unclear whether the commentor was recommending specific changes in the methods used to characterize bioaccumulation and/or biomagnification or the fenceline values used in the interpretation of those values.

…[t]he term "bioaccumulative" as used by Ecology is actually referring to biomagnification….Ecology should use the term "biomagnification" instead of "bioaccumulation" and explain the difference between these terms in the strategy… " (Loehr, pp. 1 & 3)

Ecology's review and analysis of public comments on Issue 11

Ecology continues to believe that the approach developed by EPA to evaluate bioaccumulation potential generally provides a sound basis for characterizing the bioaccumulation potential of individual chemicals and chemical groups. However, after evaluating the public comments, Ecology has decided to limit the chemicals on the PBT Working List to those that have BAF/BCF values greater than 1000 (e.g., EPA bioaccumulation score = 3).

[36] Ecology also received a number of comments questioning the bioaccumulation scores for individual chemicals or chemical groups. These are summarized and evaluated in Section IV of this document.

- *Criteria for Evaluate Bioaccumulation Potential:* Ecology reviewed the comments received on this issue[37] and has decided to modify the approach for listing PBT chemicals identified in the January 2001 proposal. Specifically, Ecology has decided to limit the PBT Working List to those chemicals that have a BAF/BCF greater than 1000. The rationale for this modified approach includes:

  – *Program Consistency:* Ecology acknowledges that scientists are not able to identify a bright line distinguishing bioaccumulative and non-bioaccumulative chemicals and that any attempt to make such distinctions is somewhat arbitrary. However, Ecology believes that using a BAF/BCF of 1000 to prepare the PBT Working List is consistent with other federal and international programs for addressing PBT chemicals.[38]

  – *Program Focus:* The modified approach will enable Ecology to focus on the most important PBT chemicals during the initial stages of the PBT initiative.

- *Use of EPA Information:* Ecology continues to believe that the information compiled by EPA provides a sound basis for characterizing the bioaccumulation potential of individual chemicals and chemical groups. There are three main reasons for this conclusion:

  – *Scientific Basis:* The EPA bioaccumulation scores are based on current high quality information. In preparing the bioaccumulation scores, EPA conducted an extensive data review in order to identify measured and predicted BAF/BCF values[39]. As discussed in Section IV and V, the bioaccumulation data for the vast majority of chemicals that Ecology is proposing to include on the PBT Working List were classified as having a "high" or "highest" data preference rating.

[37] After reviewing the comments on this issue, Ecology believes there is some confusion on the criteria or fencelines that EPA used to assign bioaccumulation scores. Specifically, it is important to understand that the WMPT includes two scoring fencelines (BAF/BCF values of 250 and 1000) that were derived from the thresholds originally used by the Office of Pollution Prevention and Toxics (OPPT) to evaluate new and existing chemicals under the Toxics Substances Control Act (EPA, 1992). EPA used the lower value (250) to distinguish between chemicals receiving a score of 1 (low potential) and 2 (medium potential); the higher value was used to distinguish between chemicals receiving a score of 2 and 3 (high potential). Under Ecology's proposal, chemicals with bioaccumulation scores of 2 or 3 could be listed as PBT chemicals (depending on the chemical's scores for persistence and toxicity).

38 Table 2 (page __) summarizes the criteria used by other federal and international organizations to evaluate bioaccumulation potential. As shown in that table, a range of criteria have been used by other programs. Some of these differences reflect differences in program objectives (e.g., information collection vs phaseout). However, it appears that all programs would consider chemicals with a BAF/BCF less than 250 are unlikely to bioaccumulate to harmful levels and that chemicals with BAF/BCF values greater than 5000 require some type of regulatory action to reduce or phase out various chemicals. Most programs have used a criterion of 1000 to identify chemicals for additional information collection, voluntary pollution measures and (in some cases) additional regulatory measures.

[39] In developing the WMPT, EPA evaluated the various sources of chemical specific information and assigned data preference rankings based on the level of confidence and/or data quality. With respect to information on bioaccumulation, EPA identified four data preference levels (highest, high, medium, low). The bioaccumulation information for most of the of the chemicals included on the PBT Working List received data quality rankings of "high" or "highest".

- *Managing Variability and Uncertainty:* Ecology believes that EPA has given careful consideration to the variability[40] and uncertainty associated with available information when developing "P", "B" and "T" scores for individual chemicals.

- *Program Consistency:* The EPA approach is consistent with approaches used by other organizations to evaluate the potential for bioaccumulation. The bioaccumulation information used to prepare the WMPT is essentially the same information used by other regulatory programs (e.g., Water Quality Criteria Development, state and federal cleanup programs) and other programs charged with identifying PBT chemicals (e.g., Toxics Release Inventory). In addition, the bioaccumulation factors/bioconcentration factors for individual chemicals included in the WMPT are generally consistent with values used by other programs and consistent with the range of values currently included in EPA's EcoTox database (EPA, 2001b).

- *Use of the Term "Bioaccumulation:* The Department has used the term bioaccumulation to maintain consistency with other programs. The use of this term reflects the focus of the PBT Strategy on chemicals that can increase from relatively low environmental concentrations (e.g., air, water, soil, and sediments) to harmful levels in plants or animals. Such increases may occur as a result of bioconcentration[41], bioaccumulation[42] and biomagnification[43]. For example, all three processes (bioconcentration, biomagnification, and bioaccumulation) operate with most aquatic organisms. Bioaccumulation and biomagnification are the most likely processes by which air breathing aquatic animals (e.g., seals, whales, and dolphins) and semiaquatic species (e.g., aquatic birds) acquire elevated levels of various chemicals. On the other hand, bioconcentration may be the sole process for organisms that draw their food and oxygen requirements from dissolved substances. Ecology plans to continue to use the term "bioaccumulation", but will attempt to clarify the differences in these terms in future documents.

12: What criteria should Ecology use to evaluate carcinogenicity?

The Department of Ecology proposed to use the information contained in the September 1998 version of the WMPT to characterize a chemical's toxicity. The WMPT includes toxicity scores based on three health and ecological endpoints (cancer, non-cancer, and ecological effects). With respect to cancer effects, EPA used information from several sources to assign toxicity scores based on either a chemical's carcinogenic potency (e.g., Slope Factors) or the likelihood

[40] For many chemicals, there is a high degree of variability across studies, species and environmental conditions. For example, the BCF values for pentachlorophenol currently included in the EcoTox database range from 5 to 45,000. EPA has used a BCF value of 776 to characterize the bioaccumulation potential for this substance. This value corresponds to approximately the 75th percentile value.

41 Bioconcentration is defined as the process by which there is a net accumulation of a chemical directly from water to aquatic organisms resulting from simultaneous uptake (e.g., by gill or epithelial tissue) and elimination. Bioconcentration represents the first step in the bioaccumulation/biomagnification process.

42 Bioaccumulation is defined as the accumulation of chemicals in the tissue of organisms through any route, including respiration, ingestion, or direct contact with contaminated air, water, diet etc.

[43] Biomagnification occurs when the processes of bioconcentration and bioaccumulation result in increasing tissue concentrations as a chemical moves up the food web (e.g., moves up two or more trophic levels).

that the chemical is a human carcinogen (e.g., the USEPA Carcinogen Weight-of-Evidence Classification[44]). EPA assigned a "data preference" rating to each information source based on the level of review and quality control associated with each information source and/or database Table 3 summarizes the information sources and criteria that EPA used to assign human cancer scores of high (3), medium (2) and low (1).

Table 3 - Human Toxicity (Cancer)

Measure/Data Source	High (3)	Medium (2)	Low (1)	Data Preference
EPA WOE Score	A	B or C	NA	NA
IARC WOE Score	1	2A or 2B	NA	NA
NTP WOE Score	NA	CE or SE or EE or P or E	NA	NA.
IRIS Oral Slope Factor (WOE A or B)	> 4.6	4.6 - 0.046	< 0.046	Highest
IRIS Oral Slope Factor (WOE C)	> 46	46 - 0.46	< 0.46	Highest
IRIS Inhalation Unit Risk (WOE A or B)	> 0.0013	0.0013 - 0.000013	< 0.000013	Highest
IRIS Inhalation Unit Risk (WOE C)	> 0.013	0.013 - 0.00013	< 0.00013	Highest
HEAST Oral Slope Factor (WOE A and B)	> 4.6	4.6 - 0.046	< 0.046	High
HEAST Oral Slope Factor (WOE C)	> 46	46 - 0.46	< 0.46	High
HEAST Inhalation Slope Factor (A & B)	> 4.6	4.6 - 0.046	< 0.046	High
HEAST Inhalation Slope Factor (WOE C)	> 46	46 - 0.46	< 0.46	High
EPA Cancer Data Oral Slope Factor (WOE A & B)	> 4.6	4.6 - 0.046	< 0.046	High
EPA Cancer Data Oral Slope Factor (WOE C)	> 46	46 - 0.46	< 0.46	High
RQ Potency Factor (WOE A or B)	> 100	100 to 1.3	< 1.3	Medium
RQ Potency Factor (WOE C)	> 1000	1000 to 1.3	< 13	Medium
Cal/EPA Inhalation Slope Factor (WOE A and B)	> 4.6	4.6 - 0.046	< 0.046	Medium
Cal/EPA Inhalation Slope Factor (WOE C)	> 46	46 - 0.46	< 0.46	Medium
Cal/EPA Oral Slope Factor (WOE A & B)	> 4.6	4.6 - 0.046	< 0.046	Medium
Cal/EPA Oral Slope Factor (WOE C)	> 46	46 - 0.46	< 0.46	Medium

As discussed under Issue 3, Ecology received several general comments that questioned Ecology reliance on WMPT values that might be out-of-date or based on data that was of poor quality. However, the Department received only one comment specifically addressing the approach used for evaluating human and ecological toxicity. One commentor submitted (as an attachment to their written comments) a comment provided to the Environmental Protection Agency by the Chemical Manufacturers Association (CMA) that included a series of recommendations for modifying the September 1998 version of the WMPT. In those comments, the CMA expressed their support for EPA's toxicity criteria and decision to focus on chemicals that received a high (3) score for human and/or ecological toxicity:

[44] The WMPT weight of evidence scoring system (e.g., A, B1, B2, C) is based on the EPA Weight of Evidence Framework described in the EPA Cancer Assessment Guidelines (1986). EPA has proposed a different approach (EPA, 1996). However, the proposed approach has never been finalized and the information in EPA's Integrated Risk Information System (IRIS) database continues to reflect the earlier framework.

…The CMA supports the fencelines used for human and ecological toxicity….CMA agrees with EPA's decision to include only chemicals with high scores for toxicity. In constructing the List, EPA limited inclusion to chemicals that scored a "3" for human toxicity or ecological toxicity…. (Perelman, Allen-Kellogg and Shipley, pp. 10 – 12 – Attachment to Comments from Howlett and Rampy)

Ecology's review and analysis of public comments on Issue 12

Ecology continues to believe that the WMPT framework for evaluating carcinogens provides a reasonable basis for identifying chemicals for inclusion on the PBT Working List. This is based on the following factors:

- *Scientific Basis:* The EPA carcinogenicity scores are based on current high quality information. In developing those scores, EPA relied upon scientific reviews and evaluations performed by toxicological experts within EPA and other organizations. As discussed in Section IV and V, most of the information used to evaluate carcinogenicity was obtained from the Integrated Risk Information System (IRIS) database.
- *Managing Variability and Uncertainty:* Ecology believes that the cancer slope factors included in the IRIS database reflect careful consideration of the variability in susceptibilities to chemical exposure and the uncertainties associated with extrapolating from high-to-low levels of exposure. The methods used by EPA to address variability and uncertainty are consistent with recommendations from expert committees (e.g., NRC, 1994; NAS, 2000a,b; NAS, 2001).
- *Program Consistency:* The WMPT framework is consistent with approaches being used by other environmental programs. For example, state and federal agencies currently use the IRIS database and HEAST values to establish cleanup standards, water quality standards, and air pollution requirements for new and existing sources. The use of this technical information and the criteria used to identify chemicals receiving a high (3) score results produces a list of chemicals that have toxicity characteristics similar to those appearing on other federal and international PBT lists.
- *Clarity:* The WMPT provides clear criteria for evaluating the carcinogenic potential of individual chemicals. This is in marked contrast to many other approaches for identifying PBT chemicals (see Table 2) that are based on more general criteria (e.g., potential to increase the risk of cancer).
- *Flexibility:* Ecology's proposal to use the WMPT framework provides the flexibility to accommodate new scientific information in that most of the underlying databases are updated on a regular basis. For example, Ecology reviewed the IRIS database and used the most current values when preparing the PBT Working List.

13: What criteria should Ecology use to evaluate non-cancer effects in humans?

The Department of Ecology proposed to use the information contained in the September 1998 version of the WMPT to characterize a chemical's toxicity. The WMPT includes toxicity scores

based on three health and ecological endpoints (cancer, non-cancer, and ecological effects). With respect to non-cancer effects, EPA used several measures related to a chemical's capacity to cause acute and chronic adverse effects in human receptors and the magnitude and severity of those effects (e.g., RfD) to assign toxicity scores. Table 4 summarizes the information sources and criteria that EPA used to assign human non-cancer scores of high, medium, and low.

Table 4 - Human Toxicity (Non-Cancer)

Data Element/Source	High (3)	Medium (2)	Low (1)	Data Preference
IRIS Reference Dose	< 0.0006	0.0006 - 0.06	> 0.06	Highest
IRIS Reference Concentration	< 0.002	0.002 - 0.2	> 0.2	Highest
Minimal Risk Level (MRL) -- Oral	< 0.0006	0.0006 - 0.06	> 0.06	High
Minimal Risk Level (MRL) - Inhalation	< 0.002	0.002 - 0.2	> 0.2	High
HEAST Reference Dose (RfD)	< 0.0006	0.0006 - 0.06	> 0.06	High
HEAST Inhalation Conc. (RfC)	< 0.002	0.002 - 0.2	> 0.2	High
Reportable Quantity (RQ)	< or = 10	100, 1000	> or = 5000	Medium
TSCA 4 Subchronic NOAEL	< 0.6	0.6 - 60	> 60	Medium
TSCA 4 Subchronic LOAEL	< 6	6 - 600	> 600	Medium
TSCA 4 Developmental NOAEL	< 50	50 - 250	> 250	Medium
TSCA 4 Developmental LOAEL	< 500	500 - 2500	> 2500	Medium
Reference Exposure Level (REL)	< 2	2 - 200	> 200	Medium
TSCA 8(e) Submission	3	2	1	Low
CESARS Oral Mammalian Sublethality Score	> or = 8	6, 4	< or = 2	Low
Human Health Structure Activity Team Rank	High	Medium	Low	Lowest

As discussed under Issue 3, Ecology received several general comments that questioned Ecology reliance on WMPT values that might be out-of-date or based on data that was of poor quality. However, the Department received only one comment specifically addressing the approach used for evaluating human and ecological toxicity. One commentor submitted (as an attachment to their written comments) a comment provided to the Environmental Protection Agency by the Chemical Manufacturers Association (CMA) that included a series of recommendations for modifying the September 1998 version of the WMPT. In those comments, the CMA expressed their support for EPA's fencelines and decision to focus on chemicals that received a high (3) score for human toxicity:

…The CMA supports the fencelines used for human and ecological toxicity….CMA agrees with EPA's decision to include only chemicals with high scores for toxicity. In constructing the List, EPA limited inclusion to chemicals that scored a "3" for human toxicity or ecological toxicity…. (Perelman, Allen-Kellogg and Shipley, pp. 10 – 12 – Attachment to Comments from Howlett and Rampy)

Ecology continues to believe that the WMPT framework for evaluating non-cancer health effects provides a reasonable basis for identifying chemicals for inclusion on the PBT Working List. This is based on the following factors:

- *Scientific Basis:* The EPA non-cancer scores are based on current high quality information. In developing those scores, EPA relied upon scientific reviews and evaluations performed by toxicological experts within EPA and other organizations. As discussed in Section IV and V, most of the information used to evaluate non-cancer health effects was obtained from the Integrated Risk Information System (IRIS) database (EPA, 2001a).

- *Managing Variability and Uncertainty:* Ecology believes that the reference doses and inhalation reference concentrations included in the IRIS database reflect careful consideration of the variability in susceptibilities to chemical exposure and the uncertainties associated with extrapolating from high-to-low levels of exposure. The methods used by EPA to address variability and uncertainty are consistent with recommendations from expert committees (e.g., NRC, 1994, NAS, 2000a, b, NAS 2001).

- *Program Consistency:* The WMPT framework is consistent with approaches being used by other environmental programs. For example, state and federal agencies currently use the IRIS database and HEAST values to establish cleanup standards, water quality standards, and air pollution requirements for new and existing sources. The use of this technical information and the criteria used to identify chemicals receiving a high (3) score results produces a list of chemicals that have toxicity characteristics similar to those appearing on other federal and international PBT lists.

- *Clarity:* The WMPT provides clear criteria for evaluating non-cancer health effects of individual chemicals. This is in marked contrast to many other approaches for identifying PBT chemicals (see Table 2) that are based on more general criteria (e.g., potential to increase the risk of cancer).

- *Flexibility:* Ecology's proposal to use the WMPT framework provides the flexibility to accommodate new scientific information in that most of the underlying databases are updated on a regular basis. For example, Ecology reviewed the IRIS database and used the most current values when preparing the PBT Working List.

14: What criteria should Ecology use to evaluate ecological toxicity?

The Department of Ecology proposed to use the information contained in the September 1998 version of the WMPT to characterize a chemical's toxicity. The WMPT includes toxicity scores based on three health and ecological endpoints (cancer, non-cancer, and ecological effects). With respect to ecological toxicity, EPA used a number of data elements representing measured or estimated chronic and acute aquatic toxicity extracted from a number of USEPA sources (e.g., Final Chronic Values, measured and estimated aquatic chronic values, EC50s, LC50s, and

aquatic toxicity reportable quantities) to assign toxicity scores. Table 5 summarizes the information sources and criteria that EPA used to evaluate ecological toxicity.

Table 5 – Ecological Toxicity

Data Elements/Sources	High (3)	Medium (2)	Low (1)	Data Pref
Sediment Quality Tier I FCV	< 0.1 mg/L	0.1 - 10 mg/L	> 10 mg/L	Highest
GLWQI Tier I FCV I	< 0.1 mg/L	0.1 - 10 mg/L	> 10 mg/L	Highest
AWQC FCV	< 0.1 mg/L	0.1 - 10 mg/L	> 10 mg/L	Highest
GLWQI Tier II SCV	< 0.1 mg/L	0.1 - 10 mg/L	> 10 mg/L	High
OPPT's Measured Chronic Value	< 0.1 mg/L	0.1 - 10 mg/L	> 10 mg/L	High
OPPT's Predicted Chronic Value	< 0.1 mg/L	0.1 - 10 mg/L	> 10 mg/L	High
GLWQI Tier I FAV	< 1 mg/L	1 - 100 mg/L	> 100 mg/L	Medium
AWQC CMC	< 1 mg/L	1 - 100 mg/L	> 100 mg/L	Medium
Measure Chronic Value from AQUIRE	< 0.1 mg/L	0.1 - 10 mg/L	> 10 mg/L	Low
Aquatic Toxicity RQ	1, 10 pounds	100, 1000 pounds	5000	Low
Measured Acute Value (LC50 or EC50)	< 1 mg/L	1 - 100 mg/L	> 100 mg/L	Low
TSCA Section 8(e) Triage Screening Result for Aquatic Toxicity Study Types	High	Medium	Low	Low
ECOSAR Predicted Chronic Value	< 0.1 mg/L	0.1 - 10 mg/L	> 10 mg/L	Lowest
ECOSAR Prediction of No Toxic Effects at Saturation (NTS)	NA	NA	1	Lowest
ECOSAR Predicted Acute Value (LC50 or EC50)	< 0.1 mg/L	1 - 100 mg/L	> 100 mg/L	Lowest

As discussed under Issue 3, Ecology received several general comments that questioned Ecology reliance on WMPT values that might be out-of-date or based on data that was of poor quality. However, the Department received only one comment specifically addressing the approach used for evaluating human health and ecological toxicity. One commentor submitted (as an attachment to their written comments) a comment provided to the Environmental Protection Agency by the Chemical Manufacturers Association (CMA) that included a series of recommendations for modifying the September 1998 version of the WMPT. In those comments, the CMA expressed their support for EPA's fencelines and decision to focus on chemicals that received a high (3) score for ecological toxicity:

…The CMA supports the fencelines used for human and ecological toxicity….CMA agrees with EPA's decision to include only chemicals with high scores for toxicity. In constructing the List, EPA limited inclusion to chemicals that scored a "3" for human toxicity or ecological toxicity…. (Perelman, Allen-Kellogg and Shipley, pp. 10 – 12 – Attachment to Comments from Howlett and Rampy)

Ecology continues to believe that the WMPT framework for evaluating ecological toxicity provides a reasonable basis for identifying chemicals for inclusion on the PBT Working List. This is based on the following factors:

- *Scientific Basis:* The EPA ecological toxicity scores are based on current high quality information. In developing those scores, EPA relied upon scientific reviews and evaluations performed by toxicological experts within EPA and other organizations. As discussed in Section IV and V, most of the information used to evaluate ecological toxicity has undergone extensive scientific review through the processes used to develop water quality criteria.

- *Managing Variability and Uncertainty:* Ecology believes that procedures used to develop various water quality criteria values reflect careful consideration of the variability in susceptibilities to chemical exposure and the uncertainties associated with extrapolating from high-to-low levels of exposure.

- *Program Consistency:* The WMPT framework is consistent with approaches being used by other environmental programs. For example, various water quality documents are used to establish cleanup standards, and water quality requirements for new and existing sources. The use of this technical information and the criteria used to identify chemicals receiving a high (3) score results produces a list of chemicals that have toxicity characteristics similar to those appearing on other federal and international PBT lists.

- *Clarity:* The WMPT provides clear criteria for evaluating the ecological toxicity potential of individual chemicals. This is in marked contrast to many other approaches for identifying PBT chemicals (see Table 2) that are based on more general criteria (e.g., potential to cause ecological effects).

- *Flexibility:* Ecology's proposal to use the WMPT framework provides the flexibility to accommodate new scientific information in that most of the underlying databases are updated on a regular basis.

15: Should Ecology include chemicals on the PBT Working List if there is limited or no evidence that they are present or used in Washington?

The initial list of nine PBT chemicals in the August 2000 draft strategy was based on the list contained in EPA National PBT Strategy. The twelve chemicals/groups of chemicals on the EPA list were screened using available environmental data to identify nine chemicals that were present and/or potentially released into Washington's environment. In the January 2001 revisions, Ecology proposed to use a similar approach to screen the 66 candidate chemicals. Specifically, Ecology proposed to include a candidate chemical on the Washington PBT List if it had been detected in one of several environmental media and/or reported as being released from Washington sources.

Several individuals and organizations supported Ecology's proposal to screen the list of candidate chemicals based on whether they are present in the Washington environment, used in Washington and/or released by Washington sources. For example:

…we believe the Strategy would be better served by: (1) Considering those chemicals identified for consideration under regional instruments ….(2) Applying its proposed screening mechanism to determine if the chemical is present in Washington's environment….(Howlett and Rampy, p. 3)

One commentor submitted (as an attachment to their written comments) comments and recommendations provided to the Environmental Protection Agency by the Chemical Manufacturers Association (CMA) in early 1999. In those comments, the CMA urged EPA to include an environmental loadings screen when preparing the RCRA PBT List:

The RCRA PBT waste minimization goal is, ostensibly, to focus private and public resources on the reduction of certain PBTs in hazardous waste. EPA claims that this effort will reduce long-term human health and ecological problems…. The Agency has not attempted to determine whether the reduction – or even elimination – of listed chemicals from RCRA hazardous waste would result in any significant reduction in the total release of these chemicals to the environment. To evaluate which candidate chemicals are currently being released from hazardous waste management activities, CMA recommends the inclusion of an environmental loadings screen. Such a screen should include an evaluation of national loadings, which would account for the loadings by industry and other sources. If industry is responsible for an insignificant, or very low, percentage of the national loadings for a candidate chemical, then this chemical would not be put on the RCRA PBT list. The EPA Cumulative Exposure Project may be a potential information source for national loadings. (Perelman, Allen-Kellogg and Shipley, p. 12 – Attachment to Comments from Howlett and Rampy)

Several individuals and organizations recommended that Ecology not limit its review to whether or not a chemical is present, used or released in Washington and urged the Department consider the risk a chemical poses to populations in Washington when deciding whether to list a particular PBT chemical. For example:

Identifying & prioritizing PBTs as to their risk to populations in Washington State is a key element in the PBT strategy. The operative concern is to identify risk, not just chemical concentrations. The presence of a PBT material does not in and of itself determine how much, if any, harm is being done to the public or environment. The WDOE needs to create a mechanism that identifies risk based on the material, background levels, sensitive populations, release mechanisms and other pertinent factors. It is here that integration with the EPA's program can bear substantial benefits. WDOE should be able to tap the EPA's knowledge base and data to create a defensible model for predicting risk under various circumstances. Convening a PBT science advisory board (SAB) to evaluate EPA's information as pertains to Washington could greatly assist WDOE in implementing this aspect of the PBT Strategy. Knowing the risk will then lead to establishing the priorities for each PBT. The department can then weigh the risks between each of the PBTs to establish an overall game plan for targeting available agency/public/private resources. (Bennett, p. 6)

In contrast to the above comments, Ecology also received several comments from organizations and individuals who criticized Ecology's proposal and argued that identification of PBT chemicals should be made solely on the basis of PBT characteristics. For example:

….chemicals should be added to the PBT list solely on the basis of the PBT values. Does the chemical persist or bioaccumulate and is it toxic? These are the questions, which should be used to add to the list. The agency may use other factors to determine which chemicals should be acted on first in terms of reduction and elimination, but the PBT list should be a complete list of PBT chemicals. This is the only way to ensure that chemicals can be added to the list in a timely manner before contamination builds up to dangerous levels in the environment. Also, it is important to generate a "clean" PBT list based on persistence, bioaccumulation and toxicity factors because if presence is made part of the screening criteria and a given chemical does not appear on the list, it will be difficult for the public to know whether the chemical is not actually a PBT or if its not on the list because it has not been found in Washington.

We are very concerned that the proposed environmental presence screen will limit the list of PBTs to only those chemicals for which extensive environmental testing has occurred. Politics, funding realities, lack of time and other factors all affect which chemicals are tested for and where tests are conducted. Even if testing has been done and the testing shows that the chemical is not widely found, the lack of detections could be due to the fact that the chemical is new to the state and is not yet being released in large quantities. Screening the chemical out based on environmental presence would prevent Ecology from addressing new releases through permits. The essence of the PBT screen needs to be whether a chemical is indeed persistent or bioaccumulative and is toxic. (Rice and Dickey, pp. 1-2)

The individuals and organizations who opposed Ecology's approach raised several questions with respect to how (from a practical standpoint) the Department would evaluate whether a chemical is present, used, or released in Washington. For example:

…A major problem with screening for environmental presence is that many chemicals are not being looked for and hence will not appear in agency databases. Additionally, the data sets that Ecology proposes to use to determine whether or not a chemical is present in Washington's environment are far from comprehensive: for example, why are Discharge Monitoring Reports, NPDES permits, etc. not listed as data sets when determining PBT releases, potential releases to the environment? Also, Ecology states (page 55) that "candidate chemicals will receive further consideration only if they are found or have the potential to be found in Washington's environment." How is Ecology determining a chemicals potential to be found in the environment? No details are given in the strategy. (Rice and Dickey, p. 2)

Ecology and the public have a basic right to know about the use and production of toxic chemicals in this state, but that right has been severely abridged. Neither Ecology nor the public has access to sufficient evidence regarding use and production. (Rice and Dickey, p. 2)

The proposed method will ignore chemicals for which little or no environmental testing has been done, chemicals for which non-point sources are a significant part of environmental releases, and new chemicals that so far have little use or production in the state. (Johnson, p.1)

Ecology needs to establish to the greatest degree possible, a comprehensive list of databases and datasets, and a plan as to how it will determine whether a chemical has the potential to be found in Washington's environment. (Johnson, p. 1)

Ecology's review and analysis of public comments on Issue 15

Ecology has reviewed the comments on this issue and continues to believe that it is appropriate to evaluate available information on uses, releases, and environmental presence before deciding whether to include chemicals on the PBT Working List. However, Ecology also believes that it would be inappropriate to use this evaluation to delay listing individual chemicals because of limited environmental or source monitoring data. Consequently, Ecology has chosen to use a combination of qualitative and quantitative information[45] to determine whether there is a reasonable basis to conclude that a chemical has been used in Washington, released by Washington sources, or found in Washington's environment. There are three main reasons why Ecology has elected to use this approach:

- *Purpose of the PBT Working List:* The purpose of the PBT Working List is to identify chemicals that may require additional measures to reduce uses, releases, or concentrations in Washington. Consequently, the need to consider available information on uses, sources, and environmental presence is explicitly reflected in the purpose behind creating the PBT Working List. The consideration of such factors is consistent with the preparation of other hazardous substance list (e.g., Sediment Management Standards, Hazardous Air Pollutants, MTCA Method A Cleanup Standards).

- *Prevention:* Ecology acknowledges the concerns raised by citizen and environmental groups that this criterion could be applied in a manner that creates an extremely large listing threshold that is inconsistent with the precautionary nature of the PBT Strategy. Consequently, Ecology has modified the January 2001 proposal to explicitly acknowledge that qualitative information on uses, sources and environmental presence will be considered in making a determination on whether there is a sufficient basis to include a chemical on the PBT Working List.

- *Practical Application:* At this time, Ecology believes there are limited practical benefits associated with including chemicals on the PBT Working List that are not an issue in Washington. Several commentors suggested that including such chemicals on the list would serve to prevent future uses and releases.

[45] SAIC (2001) compiled environmental and source information from a variety of national and state databases. This included the Washington State Fish Advisory List, the ATSDR Hazdat database for Washington State, the 1998 303(d) List, the Ecology SEDQUAL information system, Ecology's Environmental Information Management (EIM) database, the Toxics Release Inventory (1998 reporting year), and the National Toxics Inventory. This information was supplemented by information from the Puget Sound Ambient Monitoring Program, the Department of Agriculture and other sources.

16: Is it appropriate to exclude chemicals from the PBT Working List if sources and/or uses are prohibited or otherwise restricted through current regulatory programs?

In August 2000, Ecology proposed an initial list that included 5 pesticides[46] that had been banned in the United States. In the revised strategy submitted to the Washington State Legislature in January 2001, Ecology included these five pesticides and several other banned pesticides (e.g., heptachlor epoxide) among the list of chemicals that the Department intended to consider when preparing a revised list for public review and comment. Several commentors expressed the opinion that it was inappropriate to include banned pesticides on the Washington PBT list. For example:

It is appropriate to exclude pesticides banned from use in the US. It is also appropriate to exclude other chemicals banned from domestic production such as those banned as CFCs under the Montreal Protocol… (Perelman, Allen-Kellogg and Shipley, p. 11- Attachment to Comments from Howlett and Rampy)

Ecology's review and analysis of public comments on Issue 16

Ecology has reviewed the comments on this issue and continues to believe that it is appropriate to include chemicals that have been banned from use or production on the PBT list if they meet the listing criteria. Many of these chemicals are present in Washington's environment. This approach is consistent with other programs designed to address PBT chemicals. For example, DDT has been identified as a candidate substance for bans, phaseouts, and reductions (OME, 1993), a Tier I substance under the Binational Toxics Strategy (GLNPO, 1997), one of the initial PBT chemicals identified by EPA (EPA, 1998a) and a persistent organic pollutant by the United Nations Environmental Program (UNEP, 2001).

17: Has Ecology used current scientific and technical information to prepare the PBT Working List?

The Candidate PBT Chemical List released in January 2001 was developed using the September 1998 version of the Waste Minimization Prioritization Tool (WMPT). Several individuals and organizations expressed concerns that the "Persistence," "Bioaccumulation," and "Toxicity" scores for some chemicals are out-of-date and inconsistent with revised scores developed by EPA. For example:

…to identify PBT chemicals, the Department proposes to use the September 1998 version of EPA's WMPT and the numeric scores that EPA assigned to the various candidate chemicals for persistence, bioaccumulation and toxicity characteristics. Although EPA has not yet issued its final list of PBT chemicals, we understand that some of the P, B, or T numerical scores that EPA

[46] The five banned pesticides/groups of pesticides include aldrin, dieldrin, chlordane, DDT/DDD/DDE and toxaphene.

assigned to the chemicals in 1998 have been revised in response to public comments. ….. Thus, by relying on EPA's September WMPT (and the associated chemical scores and rankings), the Department would be using criteria and results that EPA itself no longer endorses. (King, p. 2)

Ecology's review and analysis of public comments on Issue 17

Ecology agrees that measures to address environmental problems must have a sound scientific and policy basis. However, Ecology believes that respect for the limits of our scientific knowledge means that the inability to develop a precise risk assessment value should not be used as a reason to postpone measures to prevent threats of serious, cumulative, and/or irreversible environmental damage. Within this overall context, Ecology has reviewed the information incorporated into the September 1998 version and believes that this information provides a sound foundation for evaluating whether to include a chemical on the PBT Working List. However, Ecology acknowledges that additional information may be available and believes the proposed approach provides the flexibility to consider new scientific information. Toward that end, Ecology has taken several steps to ensure that there is a sound scientific basis for concluding that a particular chemical meets the criteria for inclusion on the PBT Working List. These include:

- *Reliance on Information with High Data Preference:* Ecology has reviewed the information used to develop the original "P", "B", and "T" scores. Most of the data underlying the scores for the 22 chemicals/chemical groups on the proposed WA list is listed as having a "high" or "highest" data preference level.

- *Review of Public Comments and Databases:* As discussed in Section IV and V, Ecology reviewed the comments on individual chemicals and, as appropriate, modified the WMPT scores based on that new information.

- *Review of Environmental Databases:* Ecology reviewed the information in readily accessible databases (e.g., IRIS database) and incorporated values that had been revised subsequent to the publication of the September 1998 version of the WMPT.

IV. Summary of Comments on Specific Chemicals Included on the PBT Working List and Ecology's Responses

Ecology has decided to include 22 chemicals and chemical groups on the Ecology PBT Working List (PBT Working List). The PBT Working List includes chemicals that Ecology believes require greater attention because of their persistence, bioaccumulation, and toxicity characteristics. The chemicals and chemical groups on the list were identified using the following criteria:

- *Persistence:* Persistence indicates how long a chemical is expected to exist in the environment and be available for exposure. The primary measure used to evaluate persistence is the chemical's regional half-life estimated using a multi-media partitioning model included in the revised WMPT (EPA, 1998b). In order to be included on the PBT Working List, a chemical must have a regional half-life greater than 580 hours.

- *Bioaccumulation Potential:* Bioaccumulation potential is defined as "… the capacity of a chemical to increase in concentration or accumulate (be stored in tissue) in an organism as a result of uptake from all environmental sources over a period of time." (EPA, 1998b). Two types of chemical-specific measures have been used to evaluate a chemical's potential to bioaccumulate: (1) measured or predicted bioaccumulation factors (BAFs) and (2) measured or predicted bioconcentration factors (BCFs). In order to be included on the PBT Working List, a chemical must have a BAF/BCF greater than 1000.

- *Toxicity:* Toxicity refers to a chemical's potential to cause adverse effects on human health and/or the environment. EPA (1998b) reviewed available information and assigned scores for three toxicity measures (Ecological Toxicity, Human Health (Non-Cancer Effects) and Human Health (Cancer Effects). In order to be included on the PBT Working List, a chemical must have a toxicity score of 3 (high concern) for at least one of these measures.

- *Use, Release or Environmental Presence:* In order to be included on the PBT Working List, there must be some basis to conclude that a chemical has been or is currently being used in Washington, released by Washington sources or present in Washington's environment. As discussed under Issue 15, this is a screening evaluation based on a review of readily available information on the use, release, and environmental presence of chemicals meeting the persistence, bioaccumulation, and toxicity criteria.

In October 2000 and March 2001, Ecology received comments on specific chemicals and recommendations on whether those chemicals should be included (or excluded) from the PBT Working List. The following sections are designed to respond to those comments and briefly explain the rationale for including each chemical on the PBT Working List.

18: Should Ecology include aldrin on the PBT Working List?

In August 2000, Ecology proposed to focus on nine of the 12 chemicals/chemical groups identified by the Environmental Protection Agency in the national PBT strategy. Aldrin was one of those nine chemicals. Aldrin was also one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. Ecology did not receive any specific comments on aldrin. However, the Department received several comments on two general issues that are relevant to a decision on whether to include aldrin on the PBT Working List:

- A number of individuals and organizations recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

- Several individuals and organizations recommended that Ecology not include chemicals whose use and manufacture had already been banned under state and/or federal law.

Ecology's review and analysis of public comments on Issue 18

Ecology believes that aldrin should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, aldrin meets the PBT criteria used by Ecology to prepare the PBT Working List:

  - *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 2532 hours. This is consistent with (although shorter than) the range of soil half-life values (291 days – 9 years) considered by EPA when deciding whether to include aldrin among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a).

  - *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for aldrin and used a BCF value of 3715[47] to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF database file. This value is consistent with the range of BCF values currently included in EPA's EcoTox database (EPA, 2001b).

  - *Toxicity:* EPA assigned scores of 3 for all three toxicity measures. The human health score for non-cancer effects is based upon an oral RfD value (0.00003 mg/kg/day)[48]

[47] This value was also used by EPA (1999a) when evaluating whether to include aldrin on the list of PBT chemicals for purposes of reporting pursuant to the Toxics Release Inventory (TRI) program.
[48] The RfD value is based on a chronic feeding study in rats. The critical effect is liver toxicity and 1000-fold safety factor was applied to the LOAEL of 0.025 mg/kg/day. EPA assigned a medium level of confidence to the study, the database and the RfD.

published in the IRIS database (EPA, 2001a). The human health score for cancer effects was based on the oral cancer slope factor (17 (mg/kg/day)-1) published in the IRIS database (EPA, 2001a).[49] The ecological toxicity score is based on a Tier II Secondary Chronic Value (SCV) (0.00003 mg/L) developed through the Great Lakes Water Quality Initiative (EPA, 1996) [50].

- *Uses, Releases, and Environmental Presence.* Aldrin is a pesticide that was used in the past as a pre-emergence soil insecticide and a soil poison to control termites and ants. Aldrin is readily converted to dieldrin under normal environmental conditions. EPA banned the production and importation of aldrin in the United States in the 1970's. Aldrin has been found in fish tissue (@ 4 - 6 percent of fish tissue samples contained measurable amounts of aldrin) and sediment (@ 6 percent of marine sediment samples contained measurable amounts of aldrin). Aldrin/dieldrin have been identified as parameters of concern for several waterbodies or segments included on Washington's 1998 303(d) list.

- *Program Consistency:* This approach is consistent with other federal and international agencies that have included aldrin on their lists of PBT chemicals. Specifically, aldrin has been identified as a candidate substance for bans, phaseouts, and reductions (OME, 1993), a Tier I substance under the Binational Toxics Strategy (GLNPO, 1997), as one of the initial PBT chemicals identified by EPA (EPA, 1998a), a PBT chemical for purposes of reporting under EPA's Toxics Release Inventory program (EPA, 1999a) and a persistent organic pollutant (POPs) by the United Nations Environmental Program (UNEP, 2001).

19: Should Ecology include cadmium on the PBT Working List?

In August 2000, Ecology proposed to focus on nine of the 12 chemicals/chemical groups identified by the Environmental Protection Agency in the national PBT strategy. Citizen and environmental groups recommended that Ecology expand the "Starter List" to include cadmium. For example:

As a matter of sound science, failing to use the full list of 27 chemicals which Ecology originally proposed makes no sense whatsoever. All of the chemicals on that list are widely accepted to be persistent, bioaccumulative, and highly toxic. Ignoring endosulfan, pentachlorophenol, cadmium and the other now-missing PBTs will not make them go away in our environment and our children's lives. All PBTs need to be addressed, not just a handful. A chemical of the day approach fails to give our children and others the comprehensive protection they deserve. (Dansereau, p. 3)

[49] Aldrin is classified as a probable human carcinogen (B2) based on an increased tumor response in three strains of mice (both males and females). The cancer slope factor was calculated using the linearized multistage procedure.
[50] EPA (1998b) states that "…[a]n SCV is an estimated average concentration of a chemical in water that should not result in "unacceptable adverse effects" on aquatic organisms exposed for long-term durations (e.g., greater than four days). The Tier II methodology, however, has less rigorous data requirements than the methodology used to calculate the Tier I FCVs. The Tier II methodology uses statistically derived "adjustment factors" to calculate an SCV (40 CFR 132 Appendix A). The SCV also has minimum data requirements (e.g., the data set must include a daphnia test and meet specified acceptability criteria)." The source document for the Tier II SCV for aldrin is the 1995 Technical Support Document for the Hazardous Waste Identification Rule Risk Assessment (EPA, 1995b).

In January 2001, Ecology proposed to move forward to identify and rank PBT chemicals using a four-step process. Cadmium was among the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" that Ecology proposed to evaluate using this process. Several groups argued that it was inappropriate to include cadmium on this list. For example:

….a number of scientific bodies such as the International Agency for Research on Cancer (IARC) and the National Toxicology Program (NTP) in the United States have explicitly noted that any human health problems associated with exposure to cadmium arise from cadmium ions and not from insoluble forms of cadmium. Thus, as noted in the LIA comments, it is the bioavailability or solubility of metals and their metal ion concentration which determines their effect on human health and the environment, not their persistence. In fact, if an inorganic metal persists for a long period of time in the environment, that trait is positive as it will not become bioavailable for interaction with organisms. Metallic elements, by definition, are persistent. They cannot degrade into water, carbon dioxide or other harmless organic materials. The entire concept of persistence is simply irrelevant to inorganic metallic elements. Application of the U.S. EPA's Waste Minimization Prioritization Tool (WMPT) to inorganic metallic elements and their compounds produces no useful information reflecting their harmful effects on human health and the environment.…we would note that releases of cadmium are already extremely tightly regulated in the United States and around the world. Industry has made a significant effort to reduce those releases over the past theirty years and has achieved reductions of over 95% in many areas. The largest applications for cadmium at present are small nickel-cadmium (NiCd) batteries, utilized to power a wide variety of portable consumer devices, and large industrial NiCd batteries such as those employed in starting and emergency power for all Boeing aircraft. The battery industry around the world has developed extensive collection and recycling systems for these batteries and the amounts of recycled NiCd batteries have risen steadily over the past ten years.…the utilization of the PBT concept as a blanket condemnation for all forms and concentrations of cadmium is scientifically indefensible…. (Morrow, pp.1- 2)

Ecology's review and analysis of public comments on Issue 19

Ecology has reviewed the comments on this issue and continues to believe that cadmium should be included on the Washington list of PBT chemicals. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, cadmium meets the PBT criteria used by Ecology to prepare the PBT Working List:

  – *Persistence:* EPA (1998b) assigned a persistence score of three (greater than 580 hours) to cadmium and cadmium compounds.

  – *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for cadmium and used a BCF value of 4190 to characterize the bioaccumulation potential of this substance. This value is a measured BCF obtained from the Ambient Water Quality Criteria document for cadmium (EPA,

1984).[51] This value is consistent with the range of BCF values currently included in EPA's EcoTox database (EPA, 2001b).[52]

– *Toxicity:* EPA (1998b) assigned scores of 3 for all three toxicity measures. The human health score for non-cancer effects is based upon oral RfD value (0.0005 mg/kg/day)[53] published in the IRIS database. The human health score for cancer effects was based on the Inhalation Unit Risk value (0.0018 (ug/m3)-1) published in the IRIS database.[54] The ecological toxicity score is based on a Tier I Final Chronic Value (FCV) (0.0014286 mg/L) developed through the Great Lakes Water Quality Initiative (EPA, 1996) [55] and an AWQC FCV (0.001 mg/L) developed by EPA's Office of Water.[56]

- *Uses, Releases, and Environmental Presence.* Cadmium is a naturally occurring element and is used in a number of manufacturing processes including electroplating and coating, batteries, pigments and stabilizers. Cadmium has been reported to be present in fish tissue (over 40 percent of fish tissue samples compiled in Ecology's Environmental Information Management system have measurable levels of cadmium) and in marine sediments (over 60 percent of marine sediment samples contained measurable amounts of cadmium). Based on the National Toxics Inventory, an estimated 15675 lbs of cadmium are annually released into the atmosphere by Washington sources. Cadmium has been identified as a parameter of concern for several waterbodies or segments included on the Washington 1998 303(d) list.

- *Program Consistency:* Cadmium has been identified as a candidate substance for bans, phaseouts, and reductions (OME, 1993), a Tier II substance under the Binational Toxics Strategy (GLNPO, 1997) and a PBT chemical for purposes of promoting voluntary reductions under the Waste Minimization Plan (EPA, 1998d).

[51] EPA. 1985. Ambient Water Quality Criteria for Cadmium - 1984. PB85-227031.
[52] However, it is important to note that EPA (2000a) concluded that "…most studies reviewed contained data which suggest that cadmium is not a highly mobile element in aquatic food webs, and there appears to be little evidence to support the general occurrence of biomagnification of cadmium within marine or freshwater food webs…".
[53] The RfD value was based on a chronic study of humans exposed to cadmium in food and water. The critical effect was proteinuria and 10-fold safety factor was applied to the NOAEL of 0.005 mg/kg/day. EPA assigned a high level of confidence to the database and the RfD (EPA, 2001a). The Agency for Toxic Substances and Disease Registry (ATSDR) has established an MRL of 0.0002 mg/kg/day (ATSDR, 2001a)
[54] Cadmium is classified as a probable human carcinogen (B1) based on limited evidence of carcinogenicity in humans and sufficient evidence in animals. The inhalation unit risk value is based upon a study of occupational exposure to cadmium.
[55] The GLWQI values were derived using the same methods that EPA uses to derive ambient water quality criteria in cases where final residues values are not used. The source document for the Tier I FCV for cadmium is the Great Lakes Water Quality Initiative Criteria Documents for the Protection of Aquatic Life in Ambient Water (EPA, 1995b).
[56] The Ambient Water Quality Criteria FCV values were developed in the mid-1980's and distributed for public review. The values are compiled in the EcoTox Thresholds ECO Update (Volume 3 No. 2) (EPA, 1996)

20: Should Ecology include chlordane on the PBT Working List?

In August 2000, Ecology proposed to focus on nine of the 12 chemicals/chemical groups identified by the Environmental Protection Agency in the national PBT strategy. Chlordane was one of those nine chemicals. Chlordane was also one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. Ecology did not receive any specific comments on chlordane. However, the Department received several comments on two general issues that are relevant to a decision on whether to include chlordane on the PBT Working List:

- A number of individuals and organizations recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

- Several individuals and organizations recommended that Ecology not include chemicals whose use and manufacture had already been banned under state and/or federal law.

Ecology's review and analysis of public comments on Issue 20

Ecology believes that chlordane should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, chlordane meets the PBT criteria used by Ecology to prepare the PBT Working List:

  - *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 6682 hours. This is consistent with the range of soil half-life values (0.4 – 8 years) considered by EPA when deciding whether to include chlordane among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a). This is also consistent with the range of half life values (283 days – 3.8 years) reported in EPA (2000a).

  - *Bioaccumulation:* EPA (1998) evaluated the range of bioaccumulation factors/bioconcentration factors available for chlordane and used a BCF value of 21,877[57] to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF database file. This value is consistent with the range of BCF values currently included in EPA's EcoTox database (EPA, 2001b) and the bioaccumulation factors summarized in EPA (2000a).

[57] EPA (1999a) used a BCF value of 11,050 to characterize the bioaccumulation potential of chlordane when evaluating whether to include chlordane on the list of PBT chemicals for purposes of reporting pursuant to the Toxics Release Inventory (TRI) program. In addition, EPA (1999a) listed a BAF value (> 6,000,000) for piscivorous fish.

- *Toxicity:* EPA assigned scores of 3 for human health (non-cancer effects) and ecological toxicity. The human health score for non-cancer effects is based upon oral RfD value (0.00006 mg/kg/day)[58] published in the IRIS database. EPA has also classified chlordane as a probable human carcinogen and published an oral slope factor of 1.3 (mg/kg/day)-1 in the IRIS database. The ecological toxicity score is based on an AWQC FCV (0.000004 mg/L) developed by EPA's Office of Water.[59]

- *Uses, Releases, and Environmental Presence.* Chlordane is an insecticide that was registered for use for a variety of uses (e.g., home gardens, deciduous fruits, nuts, corn, vegetables, lawns and turfs, roadside and underground termite control). Importation and manufacture of this pesticide has been prohibited since 1988. However, chlordane has been reported to be present in fish tissue (19 percent of fish tissue samples collected by the Puget Sound Ambient Monitoring Program (PSAMP) have measurable levels of chlordane) and in marine sediments (9-10 percent of marine sediment samples contained measurable amounts of chlordane). Chlordane has been identified as a parameter of concern for several waterbodies or segments included on the Washington 1998 303(d) list.

- *Program Consistency:* Chlordane has been identified as a candidate substance for bans, phaseouts, and reductions (OME, 1993), a Tier I substance under the Binational Toxics Strategy (GLNPO, 1997), one of the initial PBT chemicals identified by EPA (EPA, 1998a), a PBT chemical for purposes of reporting under EPA's Toxics Release Inventory program (EPA, 1999a) and a persistent organic pollutant (POPs) by the United Nations Environmental Program (UNEP, 2001).

21: Should Ecology include DDT on the PBT Working List?

In August 2000, Ecology proposed to focus on nine of the 12 chemicals/chemical groups identified by the Environmental Protection Agency in the national PBT strategy. DDT was one of those nine chemicals. DDT is also one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. Ecology did not receive any specific comments on DDT. However, the Department received several comments on two general issues that are relevant to a decision on whether to include DDT on the PBT Working List:

- A number of individuals and organizations recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

- Several individuals and organizations recommended that Ecology not include chemicals whose use and manufacture had already been banned under state and/or federal law.

[58] The RfD value was based on a chronic feeding study in rats. The critical effect was liver toxicity and 1000-fold safety factor was applied to the LOAEL of 0.025 mg/kg/day. EPA assigned a medium level of confidence to the study, the database and the RfD.

[59] The Ambient Water Quality Criteria FCV values were developed in the mid-1980's and distributed for public review. The values are compiled in the EcoTox Thresholds ECO Update (Volume 3 No. 2) (EPA, 1996). EPA also identified available information from the OPPT (Measured Chronic data = 0.0158 mg/L)

Ecology's review and analysis of public comments on Issue 21

Ecology believes that DDT should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, DDT meets the PBT criteria used by Ecology to prepare the PBT Working List:

  - *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 36,422 hours. This is consistent with the range of soil half-life values (2 – 15.6 years) for DDT and its breakdown products (DDD and DDE) that are listed in EPA (2000a).

  - *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for DDT and used a BCF value of 29,152[60] to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF database file. This value is also consistent with the range of BCF values for DDT currently included in EPA's EcoTox database (EPA, 2001b) and the bioaccumulation factors and biota-sediment accumulation factors (BSAFs) summarized in EPA (2000a).

  - *Toxicity:* EPA assigned scores of 3 for human health (non-cancer effects) and ecological toxicity. The human health score for non-cancer effects is based upon an oral RfD value (0.0005 mg/kg/day)[61] published in the IRIS database. EPA has also classified DDT as a probable human carcinogen and published an oral slope factor of 0.24 (mg/kg/day)-1 in the IRIS database. The ecological toxicity score is based on an AWQC FCV (0.000001 mg/L) developed by EPA's Office of Water[62] and a GLWQI Tier II Secondary Chronic Value (SCV)[63] of 0.00001 mg/L.

- *Uses, Releases, and Environmental Presence:* DDT is a pesticide that was registered for use in controlling orchard, garden, field, and forest pests. Importation and manufacture of this pesticide has been prohibited since 1972 (except in public health emergencies). However, DDT and its degradation products (DDE and DDD) has been reported to be present in fish tissue (69 percent of fish tissue samples collected by the Puget Sound Ambient Monitoring Program (PSAMP) have measurable levels of DDT/DDD/DDE) and in marine sediments (90 – 100 percent of marine sediment samples contained measurable amounts of

[60] EPA (1998c) also listed BCF values for DDD (8709) and DDE (51286). The value for DDD is an estimated BCF value predicted using BCFWin (a bioconcentration factor estimation program developed by Syracuse Research Corporation). The value for DDE is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF database file.
[61] The RfD value was based on the results from a 27-week rat feeding study. The critical effect was liver lesions and a 100-fold uncertainty factor was applied to the NOEL of 0.05 mg/kg/day. EPA assigned a medium level of confidence to the study, the database, and the RfD.
[62] The Ambient Water Quality Criteria FCV values were developed in the mid-1980's and distributed for public review. The values are compiled in the EcoTox Thresholds ECO Update (Volume 3 No. 2) (EPA, 1996).
[63] The source document for the Tier II SCV value for DDT is the Technical Support Document for the Hazardous Waste Identification Rule (HWIR) Risk Assessment.

DDT/DDD/DDE). DDT/DDD/DDE have been identified as parameters concern for several waterbodies or segments included on the Washington 1998 303(d) list.

- *Program Consistency.* DDT has been identified as a candidate substance for bans, phaseouts, and reductions (OME, 1993), a Tier I substance under the Binational Toxics Strategy (GLNPO, 1997), as one of the initial PBT chemicals identified by EPA (EPA, 1998a) and a persistent organic pollutant (POPs) by the United Nations Environmental Program.

22: Should Ecology include dicofol on the PBT Working List?

Dicofol was also one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. Ecology did not receive any specific comments on dicofol. However, the Department did receive comments from several individuals and organizations who recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

Ecology's review and analysis of public comments on Issue 22

Ecology believes that dicofol should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, dicofol meets the PBT criteria used by Ecology to prepare the PBT Working List:

  – *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 1292 hours. This is consistent with the range of soil half-life values summarized in the Reregistration Evaluation Decision (RED) document prepared by EPA (1998e) in their evaluation of information under the Food Quality Protection Act (FQPA).

  – *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for dicofol and used a BCF value of 12,032 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF database file. This value is consistent with the range of BCF values currently included in EPA's EcoTox database (EPA, 2001) and values summarized in the Reregistration Evaluation Decision document for dicofol (EPA, 1998e)

  – *Toxicity:* EPA (1998b) assigned a toxicity score of 3 based on ecological effects. The ecotoxicity score was based on information contained in the ACQUIRE database on chronic effects. The chronic value 0.016 mg/L represents an LC50 (mortality) in a 30-day study with minnows. This chemical also received an eco-toxicity score of 3 based on an Aquatic Toxicity Reportable Quantity (RQ) of 10. For purposes of evaluating PBT chemicals, EPA assigned a low data preference to the ACQUIRE database and the Aquatic Toxicity RQ values. This is consistent with conclusions reached by EPA in their evaluation of information associated with the re-registration of dicofol in which they

concluded that "…[d]icofol is highly to very highly toxic to all aquatic organisms tested, including fish, invertebrates, and estuarine/marine organisms…" (EPA, 1998e).[64] Subsequent to the publication of the 1998 version of the WMPT, EPA (1998e) published a chronic reference dose of 0.0004 mg/kg/day which exceeds the non-cancer criteria.[65]

- *Uses, Release, and Environmental Presence.* EPA states that "…Dicofol is an organochlorine miticide/pesticide used for foliar applications, mostly on cotton, apples and citrus crops…"[66] (EPA, 1998f). The principal commercial product (Kelthane) is made from DDT.[67] Dicofol is registered for a variety of agricultural and non-agricultural uses in Washington.[68] However, EPA (1998e) did not identify Washington as a state where dicofol was extensively used during the years 1987 through 1996. Dicofol has been reported to be present in fish tissue (@ 5 percent of fish tissue samples contained measurable amounts of dicofol) and @ 14 percent of environmental samples (all media) in the Ecology Environmental Information Management System contained measurable amounts of dicofol.

23: Should Ecology include dieldrin on the PBT Working List?

In August 2000, Ecology proposed to focus on nine of the 12 chemicals/chemical groups identified by the Environmental Protection Agency in the national PBT strategy. Dieldrin was one of those nine chemicals. Dieldrin was also one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. Ecology did not receive any specific comments on dieldrin. However, the Department received several comments on two general issues that are relevant to a decision on whether to include dieldrin on the PBT Working List:

- A number of individuals and organizations recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

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[64] EPA (1998f) also stated that "…[dicofol is moderately to slightly toxic on an acute basis to terrestrial animals and slightly toxic to honey bees. Dicofol has also been shown to cause reproductive effects in avian and mammalian species. For avian species, laboratory studies suggest that reproductive sensitivity varies greatly, with raptors apparently the most sensitive." With respect to human health, EPA has calculated a chronic oral reference dose (RfD) of 0.004 mg/kg/day. This is based on hormonal effects seen in both sexes of an oral chronic dog study. EPA has also calculated an acute dietary reference dose of 0.05 mg/kg/day based on neurotoxic effects observed after a single dose in a rat acute neurotoxicity study.

[65] EPA (1998e) states "…[t]o estimate chronic dietary risk, the endpoint chosen was hormonal toxicity observed in a chronic toxicity study in dogs (MRID 40997101). The NOAL was 0.12 mg/kg/day and the LOAEL was 0.82 mg/kg/day, based on inhibition of adrenal cortical trophic hormone (ACTH) stimulated release of cortisol in both sexes of dogs. The NOAEL is divided by an Uncertainty Factor of 300 (10X for interspecies variation, 10X for intra-species extrapolation, and 3X for FQPA), resulting in the chronic RfD of 0.0004 mg/kg/day. The FQPA Safety Factor of 3X is applied to the chronic dietary risk assessment for all population subgroups."

[66] EPA states that "…[o]ther crops include: strawberries, mint, beans, peppers, tomatoes, pecans, walnuts, stonefruit, cucurbits and non-residential lawns/ornamentals…" (EPA, 1998f)

[67] EPA (1998e) states that "…[d]icofol contains <0.1% DDT and its residues in its residues in its current formulation."

[68] The crop profiles included on the Pesticide Information Center On-Line (PICOL) website include eight entries for dicofol (Dr. Michael Norman, 2002, personal communication).

- Several individuals and organizations recommended that Ecology not include chemicals whose use and manufacture had already been banned under state and/or federal law.

Ecology's review and analysis of public comments on Issue 23

Ecology believes that dieldrin should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, dieldrin meets the PBT criteria used by Ecology to prepare the PBT Working List:

  – *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 1366 hours. This is consistent (although significantly lower) than the range of soil half-life values (175 days – 3 years) listed in EPA (2000a).[69]

  – *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for dieldrin and used a BCF value of 4466 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF database file. This value is consistent with the range of BCF values currently included in EPA's EcoTox database (EPA, 2001b) and BCF values summarized in EPA (2000a).

  – *Toxicity:* EPA assigned scores of 3 for all three toxicity measures. The human health score for non-cancer effects is based upon oral RfD value (0.00003 mg/kg/day)[70] published in the IRIS database (EPA, 2001a). The human health score for cancer effects was based on the oral cancer slope factor (16 (mg/kg/day)-1) published in the IRIS database (EPA, 2001a).[71] The ecological toxicity score is based on a Sediment Quality Tier I FCV (0.000062 mg/L), a Tier I Final Chronic Value (FCV) (0.000557 mg/L) developed through the Great Lakes Water Quality Initiative [72] and an AWQC FCV (0.000002 mg/L) developed by EPA's Office of Water.[73]

[69] EPA (2000a0 states that "…dieldrin is one of the most persistent of the chlorinated hydrocarbons and is highly resistant to biodegradation and abiotic degradation…" (p. 382)

[70] The RfD value was based on the results of a two-year rat feeding study. The critical effect was liver lesions and 100-fold uncertainty factor was applied to the NOAEL of 0.005 mg/kg/day. EPA assigned a low level of confidence to the study and a medium level of confidence to the database and the RfD. (EPA, 2001a)

[71] Dieldrin is classified as a probable human carcinogen (B2) based on sufficient evidence of carcinogenicity in animals [This is equivalent to "known/likely" category reflected in the1996 proposed revisions to the Agency's carcinogen classification system (EPA, 1996). To date, EPA has not issued final revised cancer guidelines.] The cancer slope factor was calculated using the linearized multistage procedure based on increased rates of liver carcinoma in mice. (EPA, 2001a)

[72] The GLWQI values were derived using the same methods that EPA uses to derive ambient water quality criteria in cases where final residues values are not used. The source document for the Tier I FCV for cadmium is the Great Lakes Water Quality Initiative Criteria Documents for the Protection of Aquatic Life in Ambient Water (EPA, 1995b).

[73] The Ambient Water Quality Criteria FCV values were developed in the mid-1980's and distributed for public review. The values are compiled in the EcoTox Thresholds ECO Update (Volume 3 No. 2) (EPA, 1996)

- *Uses, Releases, and Environmental Presence.* Dieldrin is a pesticide that was used in the past as a pre-emergence soil insecticide and a soil poison to control termites and ants. Importation and manufacture has been prohibited in the United States since the mid-1970s. Dieldrin has been found in fish tissue (@ 6 percent of fish tissue samples collected by the Puget Sound Ambient Monitoring Program (PSAMP) contained measurable amounts of alrdin dieldrin) and sediments (@ 6 percent of marine sediment samples contained measurable amounts of aldrin/dieldrin). Aldrin/dieldrin have been identified as parameters of concern for several waterbodies or segments included on the Washington 1998 303(d) list.

- *Program Consistency.* Dieldrin has been identified as a candidate substance for bans, phaseouts, and reductions (OME, 1993), a Tier I substance under the Binational Toxics Strategy (GLNPO, 1997), as one of the initial PBT chemicals identified by EPA (EPA, 1998a) and a persistent organic pollutant (POP) by the United Nations Environmental Program (UNEP, 2001).

24: Should Ecology include dioxins and furans on the PBT Working List?

In August 2000, Ecology proposed to focus on nine of the 12 chemicals/chemical groups identified by the Environmental Protection Agency in the national PBT strategy. Dioxins/furans were included on that initial list. Dioxins/furans were also one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. Ecology did not receive any specific comments on dioxins/furans. However, the Department did receive comments from several individuals and organizations who recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

Ecology's review and analysis of public comments on Issue 24

Ecology believes that dioxins and furans should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, dioxin/furans meet the PBT criteria used by Ecology to prepare the PBT Working List:

  – *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 10,986 hours. This is consistent with the range of soil half-life values (1.5 – 20 years) considered by EPA when deciding whether to include several dioxin and dioxin-like compounds among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a).

  – *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for dioxins/furans and used a BCF value of 5754 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF database file. This value is virtually identical to BCF value that EPA used for

2,3,7,8-tetrachlorodibenzo-p-dioxin[74] when deciding whether to include several dioxin and dioxin-like compounds among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a).

  - *Toxicity:* EPA (1998b) assigned scores of 3 for all three toxicity measures. The human health score for non-cancer effects was based upon a Minimal Risk Level (0.000000001 mg/kg/day) developed by the Agency for Toxics Substances and Disease Registry (ATSDR). The human health score for cancer effects was based on the oral cancer slope factor (150,000 (mg/kg/day)-1) published in the Health Effects Assessment Summary Tables (HEAST).[75] The ecological toxicity score was based on based on information contained in the ACQUIRE database. The acute value (0.25 mg/L) represents an EC50 (growth rate) in a 4-day study with oysters. This chemical also received an eco-toxicity score of 3 based on acute and chronic values predicted on the basis of structure-activity relationships. For purposes of evaluating PBT chemicals, EPA assigned a low data preference to the ACQUIRE database and the lowest data preference to structure-activity data.

- *Uses, Releases, and Environmental Presence.* Dioxins/furans are unintentional combustion by-products resulting from a variety of natural and anthropogenic (man-made) combustion processes. Dioxins/furans have been found in fish tissue (@ ???? percent of fish tissue samples collected by the Puget Sound Ambient Monitoring Program (PSAMP) and analyzed for dioxins/furans contained measurable amounts of these substances) and sediments (@ 40 percent of the marine sediment samples analyzed for dioxins/furans contained measurable amounts of these substances). Dioxin has been identified as a parameter of concern for several waterbodies or segments included on the Washington 1998 303(d) list.

- *Program Consistency.* Dioxins/furans have been identified as a candidate substance for bans, phaseouts, and reductions (OME, 1993), a Tier I substance under the Binational Toxics Strategy (GLNPO, 1997), as one of the initial PBT chemicals identified by EPA (EPA, 1998a), a PBT chemical for purposes of reporting under the Toxics Release Inventory program (EPA, 1999a) and a persistent organic pollutant (POP) by the United Nations Environmental Program (UNEP, 2001).

25: Should Ecology include endosulfan on the PBT Working List?

In August 2001, Ecology proposed to focus on nine of the 12 chemicals/chemical groups identified by the Environmental Protection Agency in the national PBT strategy. Citizen and environmental groups recommended that Ecology expand the "Starter List" to include endosulfan. For example:

[74] EPA (1999a) listed BCF values for 17 dioxin/dioxin-like compounds. BCF values ranged from 1,259 to 42,500.
[75] Dioxin mixtures (ICDD, PCDD, HxCDD) are classified as a probable human carcinogen (B2) based on sufficient evidence of carcinogenicity in animals [This is equivalent to "known/likely" category reflected in the1996 proposed revisions to the Agency's carcinogen classification system (EPA, 1996). To date, EPA has not issued final revised cancer guidelines.] The cancer slope factor was calculated using the linearized multistage procedure based on increased rates of liver carcinoma in mice and rats. (EPA, 2001a)

As a matter of sound science, failing to use the full list of 27 chemicals which Ecology originally proposed makes no sense whatsoever. All of the chemicals on that list are widely accepted to be persistent, bioaccumulative, and highly toxic. Ignoring endosulfan, pentachlorophenol, cadmium, and the other now-missing PBTs will not make them go away in our environment and our children's lives. All PBTs need to be addressed, not just a handful. A chemical of the day approach fails to give our children and others the comprehensive protection they deserve. (Dansereau, pp. 3)

In January 2001, Ecology proposed to move forward to identify and rank PBT chemicals using a four-step process. Endosulfan was among the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" that Ecology proposed to evaluate using this process. One commentor argued that it was inappropriate to include endosulfan on this list.

In this response the ETF [Endosulfan Task Force] is only addressing those issues and areas of concern that are being considered by WA State Dep. of Ecology for screening and prioritizing chemicals. In view of the chemical listing being based on the criteria of EPA's Waste Minimization Prioritization Tool, we would like to re-emphasize that none of those defining characteristics are met by Endosulfan:

1. *Endosulfan is neither being manufactured nor formulated in the State of Washington; there are no RCRA related waste issues.*
2. *Endosulfan does not appear on any of the seven cited WA State environmental databases; nor are we aware of any other WA State monitoring data identifying Endosulfan as a pollutant.*
3. *Its environmental exposure or presence is insignificant based on its use as an insecticide in relatively small amounts (during 2000 = 34,000 acres treated).*
4. *Based on the very comprehensive environmental database including many field studies, it was demonstrated that Endosulfan does not persist nor bioaccumulate in the environment.*
5. *It should also be known that its exposure to water systems adjacent to treated fields is minimized by a 300-foot buffer zone (label). (Volger, pp. 1-2)*

Ecology's review and analysis of public comments on Issue 25

Ecology has reviewed the comments on this issue and believes that endosulfan should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, endosulfan meets the PBT criteria used by Ecology to prepare the PBT Working List:
  - *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 1025 and 1027 hours for the alpha- and beta- forms, respectively. These values are consistent with conclusions reached by EPA during the reregistration process conducted under the Food Quality Protection Act.[76]

[76] Thurman et al. (2001) concluded that "…based on environmental fate laboratory studies, terrestrial field dissipation studies, available models, monitoring studies, and published literature, it can be concluded that

- *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for endosulfan and used BCF values of 10,964 and 9,772 hours to characterize the bioaccumulation potential for the alpha- and beta-forms of endosulfan, respectively. These values are based on a measured bioconcentration factors included in the Syracuse Research Corporation BCF database file. These values are consistent with the range of BCF values currently included in EPA's EcoTox database (EPA, 2001). However, EPA has requested a new bioaccumulation study to clarify the extent of bioaccumulation. (Thurman et al. 2001).[77]

- *Toxicity:* EPA assigned a score of 3 for ecological impacts[78]. The ecological toxicity score is based on a Tier II Secondary Chronic Value (SCV) (0.00005 mg/L) developed through the Great Lakes Water Quality Initiative [79] and an AWQC FCV (0.000009 mg/L) developed by EPA's Office of Water.[80] This is consistent with the evaluation of Thurman et al. (2001) who concluded that "…[e]ndosulfan is highly toxic to nontarget aquatic and terrestrial animals…"

- *Uses, Releases, and Environmental Presence.* Endosulfan is a pesticide currently registered for a variety of agricultural uses in Washington.[81] Information compiled by the Washington Agricultural Statistical Service (1999, 2000) indicate that endosulfan was used in Washington for several food crops (e.g., apples, cherries, pears, and peaches) during the years 1997-1999. One or more forms of endosulfan have been found in fish tissue (@ 1 – 5 percent of fish tissue samples collected included in the Environmental Information Management database that were analyzed for this substance contained measurable amounts of endosulfan) and other environmental media (14 percent of the environmental samples included in the Environmental Information Management system that were analyzed for this

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endosulfan is a very persistent chemical which may stay in the environment for lengthy periods of time, particularly in acid media…" Similar conclusions were reached by Milan (2001) in EPA's review of the May 10, 2000 comments prepared by the Endosulfan Task Force. The Endosulfan Task Force comments submitted to EPA appear to be similar (if not identical) to the comments provided by the Endosulfan Task Force on the Ecology PBT Strategy.

[77] Thurman et al stated "… based on available data, it appears that endosulfan is not likely to be strongly bioaccumulative. On the one hand, there is the fact that the chemical has a relatively high octanol/water partition coefficient (Kow = 55500-61400) and bioaccumulation factors (2429 X for edible tissue). On the other hand, one study presented a depuration half-life of 33 hours, and another study indicated that residues are likely to be endosulfan-sulfate. Furthermore, in a farm pond runoff study, alpha and beta endosulfan were not present in fish samples collected, only the endosulfan-sulfate was detected. The fact that endosulfan depurates rapidly from fish hinders further bioaccumulation in the food web. The Agency has requested a new Bioaccumulation in Fish study because the above mentioned studies do not follow current guidelines. The new study will clarify the actual extent of bioaccumulation and the rate of depuration of endosulfan and/or its transformation products in fish…."

[78] Subsequent to September 1998, EPA identified endosulfan as a potential endocrine disruptor and requested that registrants conduct a developmental neurotoxicity study (Mendez, 2000, Thurman et al. 2001).

[79] The GLWQI values were derived using the same methods that EPA uses to derive ambient water quality criteria in cases where final residues values are not used. The source document for the Tier I FCV for endosulfan is the Great Lakes Water Quality Initiative Criteria Documents for the Protection of Aquatic Life in Ambient Water (EPA, 1995b).

[80] The Ambient Water Quality Criteria FCV values were developed in the mid-1980's and distributed for public review. The values for endosulfan are compiled in the 1995 Draft Quality Criteria for Water (EPA, 1995?)

[81] The crop profiles included on the Pesticide Information Center On-Line (PICOL) website include 32 entries for endosulfan and the Department of Agriculture has issued several SLN registrations to allow endosulfan use on various crops (Dr. Michael Norman, 2002, personal communication).

substance contained measurable amounts of endosulfan). Endosulfan has been identified as a parameter of concern for 6 waterbodies or segments included on the Washington 1998 303(d) list.

- *Program Consistency:* Endosulfan was identified as a candidate substance for bans, phaseouts, and reductions (OME, 1993). EPA identified endosulfan as a PBT chemical for the purpose of promoting voluntary reductions of PBT chemicals under the Waste Minimization Program (EPA, 1998d). However, EPA has recently stated (Thurman et al. 2001) that endosulfan does not show all three characteristics of a PBT compound.[82]

26: Should Ecology include heptachlor epoxide on the PBT Working List?

In August 2000, Ecology proposed to focus on nine of the 12 chemicals/chemical groups identified by the Environmental Protection Agency in the national PBT strategy. Heptachlor epoxide was included on that initial list. Heptachlor epoxide was also one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. Ecology did not receive any specific comments on heptachlor epoxide. However, the Department received several comments on two general issues that are relevant to a decision on whether to include heptachlor epoxide on the PBT Working List:

- A number of individuals and organizations recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

- Several individuals and organizations recommended that Ecology not include chemicals whose use and manufacture had already been banned under state and/or federal law.

Ecology's review and analysis of public comments on Issue 26

Ecology believes that heptachlor epoxide should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, heptachlor epoxide meets the PBT criteria used by Ecology to prepare the PBT Working List:

  – *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 2545 hours. This is consistent with the range of soil half-life values (1.5 – 20 years) considered by EPA when deciding whether to include heptachlor among

[82] EPA has requested that the registrant complete a bioaccumulation study in fish. Thurman et al. recommended that considerations of high persistence and toxicity be addressed and measurements of precaution be taken at the time of reregistration under the FQPA. Ecology intends to review the bioaccumulation study results prior to making a final determination on including endosulfan on the PBT Working List.

the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a) and conclusions in EPA (2000a)[83].

- *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/ bioconcentration factors available for heptachlor epoxide and used a BCF value of 14,454 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF database file. This value is consistent with the value (19,953) that EPA used when deciding whether to include heptachlor among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a). This value is also consistent with the range of BCF values currently included in EPA's EcoTox database (EPA, 2001b) and BCF values summarized in EPA (2000a).

- *Toxicity:* EPA (1998b) assigned scores of 3 for all three toxicity measures. The human health score for non-cancer effects was based upon oral RfD value (0.000013 mg/kg/day)[84] published in the IRIS database. The human health score for cancer effects was based on the oral cancer slope factor (9.1 (mg/kg/day)-1) published in the IRIS database (EPA, 2001a).[85] The ecological toxicity score was based on a Tier II Secondary Chronic Value (FCV) (0.0005 mg/L) developed through the Great Lakes Water Quality Initiative [86] and an AWQC FCV (0.000004 mg/L) developed by EPA's Office of Water.[87]

- *Heptachlor/heptachlor epoxide has been used in Washington and is present in Washington's environment.* Heptachlor epoxide is a breakdown product of heptachlor which is a pesticide that was extensively used in the past for killing insects in homes, buildings and on food crops. Importation and manufacture has been prohibited in the United States since 1988. Heptachlor epoxide has been found in fish tissue 15 percent of fish tissue samples compiled in the Environmental Information Management System contained measurable amounts of heptachlor epoxide)[88] and sediments (@ 1 percent of marine sediment samples contained measurable amounts of heptachlor epoxide). Heptachlor epoxide has identified as a parameter of concern for several waterbodies or segments included on the Washington 1998 303(d) list.

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[83] EPA (2000a) stated that "….heptachlor is resistant to degradation and, therefore, persistent in the environment."

[84] The RfD value was based on the results of a 60-week dog feeding study. The critical effect was increased liver-to-body weight ratios in males and females and 1000-fold uncertainty factor was applied to the LEL of 0.0125 mg/kg/day. EPA assigned a low level of confidence to the study and the RfD and a medium level of confidence to the database. (EPA, 2001a)

[85] Heptachlor epoxide is classified as a probable human carcinogen (B2) based on sufficient evidence of carcinogenicity in animals [This is equivalent to "known/likely" category reflected in the1996 proposed revisions to the Agency's carcinogen classification system (EPA, 1996). To date, EPA has not issued final revised cancer guidelines.] The cancer slope factor was calculated using the linearized multistage procedure based on increased rates of liver carcinomas in mice. (EPA, 2001a)

[86] The GLWQI values were derived using the same methods that EPA uses to derive ambient water quality criteria in cases where final residues values are not used. The source document for the Tier I FCV for cadmium is the Great Lakes Water Quality Initiative Criteria Documents for the Protection of Aquatic Life in Ambient Water (EPA, 1995b).

[87] The Ambient Water Quality Criteria FCV values were developed in the mid-1980's and distributed for public review. The values are compiled in the EcoTox Thresholds ECO Update (Volume 3 No. 2) (EPA, 1996)

[88] Heptachlor epoxide was not detected in over 900 samples collected by the Puget Sound Ambient Monitoring Program.

- *Program Consistency*. Heptachlor/heptachlor epoxide has been identified as a candidate substance for bans, phaseouts, and reductions (OME, 1993), a Level II substance under the Binational Toxics Strategy (GLNPO, 1997), one of the initial PBT chemicals identified by EPA (EPA, 1998a), a PBT chemical for purposes of reporting under EPA's Toxics Release Inventory program (EPA, 1999a) and a persistent organic pollutant (POPs) by the United Nations Environmental Program.

27: Should Ecology include hexachlorobenzene on the PBT Working List?

In August 2000, Ecology proposed to focus on nine of the 12 chemicals/chemical groups identified by the Environmental Protection Agency in the national PBT strategy. Hexachlorobenzene was included on that initial list. Hexachlorobenzene was also one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. Ecology did not receive any specific comments on hexachlorobenzene. However, the Department did receive comments from several individuals and organizations who recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

Ecology's review and analysis of public comments on Issue 27

Ecology believes that hexachlorobenzene should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, hexachlorobenzene meets the PBT criteria used by Ecology to prepare the PBT Working List:

  – *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 18757 hours. This is consistent with the range of soil half-life values (1.5 – 20 years) considered by EPA when deciding whether to include hexachlorobenzene among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a).

  – *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/ bioconcentration factors available for hexachlorobenzene and used a BCF value of 18,620 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF database file. This value is consistent, although somewhat lower, than the range of values[89] that EPA used when deciding whether to include hexachlorobenzene among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a). The value in the WMPT

[89] EPA (1999a) listed a range of BCF values (29,600 – 66,000) and a bioaccumulation factor for piscivorous fish (> 2,500,000)

database is also consistent with the range of BCF values currently included in EPA's EcoTox database (EPA, 2001b).

- *Toxicity:* EPA assigned a toxicity score of 3 based on ecological effects. The ecotoxicity score was based on information contained in the ACQUIRE database on chronic effects. The chronic value 0.016 mg/L represents an EC50 (reproductive effects) in a 14-day study with daphnia. For purposes of evaluating PBT chemicals, EPA assigned a low data preference to the ACQUIRE database.

- *Uses, Releases, and Environmental Presence.* Hexachlorobenzene was formerly used a pesticide to protect the seeds of onions, sorghum and wheat against fungus. Currently, there are no commercial uses of hexachlorobenzene in the United States, but it is a by-product from making other chemicals.[90] Based on information in the National Toxics Inventory, an estimated 424 lbs/year of hexachlorobenzene is released by Washington sources. Hexachlorobenzene has been found in fish tissue (@ 4 percent of fish tissue samples collected by the Puget Sound Ambient Monitoring Program (PSAMP) contained measurable amounts of HCB) and sediments (@ 8 percent of marine sediment samples contained measurable amounts of HCB). HCB has been identified as a parameter of concern for several waterbodies or segments included on the Washington 1998 303(d) list.

- *Program Consistency.* Hexachlorobenzene has been identified as a candidate substance for bans, phaseouts, and reductions (OME, 1993), a Level I substance under the Binational Toxics Strategy (GLNPO, 1997), one of the initial PBT chemicals identified by EPA (EPA, 1998a), a PBT chemical for purposes of promoting voluntary reductions under the Waste Minimization Plan (EPA, 1998d), a PBT chemical for purposes of reporting under EPA's Toxics Release Inventory program (EPA, 1999a) and a persistent organic pollutant (POPs) by the United Nations Environmental Program.

28: Should Ecology include hexachlorobutadiene on the PBT Working List?

Hexachlorobutadiene is one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. Ecology did not receive any specific comments on hexachlorobutadiene. However, the Department did receive comments from several individuals and organizations who recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

[90] Hexachlorobenzene and pentachlorobenzene have been identified as a minor impurities in several pesticides including chorothalonil, dacthal, picloram, pentanitrochlorobenzene, endosulfan, clopyrilid, simazine, atrazine, chlorpyrifos-methyl (Smith, 1998). Smith estimated that dietary cancer risks associated with these pesticide impurities are approximately 10-6.

Ecology's review and analysis of public comments on Issue 28

Ecology believes that hexachlorobutadiene should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, hexachlorobutadiene meets the PBT criteria used by Ecology to prepare the PBT Working List:

  – *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 4506 hours.

  – *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for hexachlorobutadiene and used a value of 6918 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF database file. This value is consistent with the range of BCF values currently included in EPA's EcoTox database (EPA, 2001). This value is also consistent with, but somewhat higher than, the BAF values used by EPA to update the ambient water quality criteria for hexachlorobutadiene. In that analysis, EPA used BAF values of 1,518, 2,389 and 1,294 for trophic levels two, three and four, respectively (EPA, 1998e).

  – *Toxicity:* EPA (1998b) assigned a toxicity score of 3 to hexachlorobutadiene for both human health[91] and ecological impacts. The human health score for non-cancer effects is based upon oral RfD value (0.0002 mg/kg/day)[92] published in the HEAST database The ecotoxicity score was based on information contained in the ACQUIRE on acute (LC50 (mortality) of 0.09 in a four-day study with goldfish). EPA assigned a low data preference to the ACQUIRE database.

- *Uses, Releases, and Environmental Presence.* Hexachlorobutadiene is used for a variety of purposes including manufacturing rubber and various lubricants, solvent, heat transfer liquid and hydraulic fluid. Hexachlorobutadiene has been found to present in fish tissue (@ 2 percent of fish tissue samples contained measurable amounts of hexachlorobutadiene) and sediment (@ 4 percent of sediment samples contained measurable amounts of hexachlorobutadiene). Based on information in the National Toxics Inventory, it is estimated that Washington sources released approximately 2 lbs of hexachlorobutadiene during 1999.

- *Program Consistency.* Hexachlorobutadiene has been identified as a PBT chemical under EPA's Waste Minimization Program (EPA, 1998d), a bioaccumulative chemical of concern pursuant to EPA water quality guidance for the Great Lakes (EPA, 1995a) and as a Level II substance under the Binational Toxics Strategy (GLNPO, 1997).

[91] The human health score for cancer effects in EPA (1998b) was based on the oral cancer slope factor (16 (mg/kg/day)-1) published in the IRIS database. However, the current oral cancer slope factor published in the IRIS database is 0.078 (mg/kg/day)-1.
[92] The RfD value was based on a value published in the HEAST database.

29: Should Ecology include hexachlorocyclohexane (Lindane) on the PBT Working List?

Hexachlorocyclohexane (Lindane or HCH) was one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. Ecology did not receive any specific comments on hexachlorocyclohexane. However, the Department did receive comments from several individuals and organizations who recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

Ecology's review and analysis of public comments on Issue 29

Ecology believes that hexachlorocyclohexane (Lindane or HCH) should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, hexachlorocyclohexane meets the PBT criteria used by Ecology to prepare the PBT Working List:

  - *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 2330 hours.

  - *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for Lindane and used a BAF value of 32,600 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioaccumulation factor included in HWIR database. This value is consistent with the range of BCF values currently included in EPA's EcoTox database (EPA, 2001b).

  - *Toxicity:* EPA (1998b) assigned scores of 3 for both human health and ecological toxicity. The human health score for non-cancer effects is based upon oral RfD value (0.0003 mg/kg/day)[93] published in the IRIS database. The ecological toxicity score is based on an AWQC FCV (0.000002 mg/L) developed by EPA's Office of Water[94] and an OPPT measured chronic data (0.0035 mg/L) that corresponds "a threshold concentration of a chemical in water at which statistically significant effects on an aquatic test population's survival, growth, or reproduction are expected to occur.

- *Hexachlorocyclohexane (Lindane) is present in Washington's environment and released by Washington sources.* Lindane is a pesticide that was used in the past as a broad-spectrum insecticide on fruit and vegetable crops and forest crops. It is also used in ointments to treat head and body lice. Lindane has been found in fish tissue (@ 1 percent of fish tissue samples

[93] The RfD value was based on the results of a subchronic rat oral bioassay. The critical effect was liver and kidney toxicity and 1000-fold uncertainty factor was applied to the NOAEL of 0.33 mg/kg/day. EPA assigned a medium level of confidence to the study, database, and the RfD. (EPA, 2001a)

[94] The Ambient Water Quality Criteria FCV values were developed in the mid-1980's and distributed for public review. The values are compiled in the EcoTox Thresholds ECO Update (Volume 3 No. 2) (EPA, 1996)

collected by the Puget Sound Ambient Monitoring Program (PSAMP) contained measurable amounts of Lindane) and sediments (@ 4 percent of marine sediment samples contained measurable amounts of Lindane).

- *Program Consistency.* Hexachlorocyclohexane has been identified as a candidate substance for bans, phaseouts, or reductions (OME, 1993), a PBT chemical under EPA's Waste Minimization Program (EPA, 1998d), a bioaccumulative chemical of concern pursuant to EPA water quality guidance for the Great Lakes (EPA, 1995a) and as a Level II substance under the Binational Toxics Strategy (GLNPO, 1997).

30: Should Ecology include lead on the PBT Working List?

In August 2001, Ecology proposed to focus on nine of the 12 chemicals/chemical groups identified by the Environmental Protection Agency in the national PBT strategy. Citizen and environmental groups recommended that Ecology expand the "Starter List" to include lead. For example:

In short, the list of 27 chemicals initially put forth by Ecology needs to be the starting list for the PBT initiative. We also reiterate our request that lead be added to this list bringing the total up to 28. Lead persists forever, builds up in bones, and is clearly toxic in minute concentrations. The sooner we begin to eliminate the use and release of lead, the sooner we can make progress in reducing the lead body burdens borne by so many children and others in Washington state and elsewhere. (Dansereau, pp. 3-4)

In January 2001, Ecology proposed to move forward to identify and rank PBT chemicals using a four-step process. Lead was among the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" that Ecology proposed to evaluate using this process. Several groups argued that it was inappropriate to include lead on this list (See Issues 4 and 5).

Ecology's review and analysis of public comments on Issue 30

Ecology has reviewed the comments on this issue and believes that lead should be included on the Washington list of PBT chemicals. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, lead meets the PBT criteria used by Ecology to prepare the PBT Working List:

  - *Persistence:* EPA (1998b) assigned a persistence score of three (greater than 580 hours) to lead and lead compounds.

  - *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/ bioconcentration factors available for lead and used a BCF value of 1700 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor used by EPA when preparing the ambient water quality criteria

document for lead (EPA, 1985). This value is consistent with the range of BCF values currently included in EPA's EcoTox database (EPA, 2001b).[95]

– *Toxicity:* EPA (1998b) assigned scores of 3 for both human health and ecological toxicity. The human health score for non-cancer effects[96] was based upon a Reportable Quantity (RQ) value of 10. The ecological toxicity score is based on an AWQC FCV (0.0025 mg/L) developed by EPA's Office of Water[97] and an OPPT measured chronic data (0.125 mg/L) that corresponds "a threshold concentration of a chemical in water at which statistically significant effects on an aquatic test population's survival, growth, or reproduction are expected to occur.

- *Uses, Releases, and Environmental Presence.* Lead is a naturally occurring element and is found in a number products (e.g., batteries, solder, pipes, ammunition, and medical devices such as X-ray shields). Many former uses have been discontinued due to health concerns (e.g., use of lead as a gasoline additive, use of lead in paint). Based on information in the National Toxics Inventory, an estimated 284,981 lbs of lead are released into the air by Washington sources. In 1999, ten Washington sources reported water discharges totaling 1018 lbs. Lead is present in fish tissue (@ 10 percent of fish tissue samples collected by the Puget Sound Ambient Monitoring Program and analyzed for lead have measurable levels of cadmium) and in marine sediments (over 80 percent of marine sediment samples contained measurable amounts of lead). Lead has been identified as a parameter of concern for several waterbodies or segments included on the Washington 1998 303(d) list.

- *Program Consistency.* Lead and/or lead compounds have been identified as a candidate substance for bans, phaseouts, and reductions (OME, 1993), a Level I substance (alkyl-lead) under the Binational Toxics Strategy (GLNPO, 1997), one of the initial PBT chemicals (alkyl-lead) identified by EPA (EPA, 1998b), a PBT chemical for purposes of promoting voluntary reductions under the Waste Minimization Plan (EPA, 1998d).

[95] EPA (200a) concluded that "…the amount of bioavailable lead in sediment is controlled, in large part, by the concentration of acid volatile sulfides (AVS) and organic matter [3, 4, 5]. Lead is accumulated by aquatic organisms equally from water and dietary exposure [6]. In sediments, a portion of lead can be transformed to trimethyllead and tetraalkyllead compounds through chemical and microbial processes. The organolead compounds are much more toxic to aquatic organisms than are the inorganic lead compounds [7]. Bioaccumulation of organolead compounds is rapid and high; these compounds concentrate in the fatty tissues of aquatic organisms…."

[96] Health effects associated with chronic exposure is one of the most significant environmental health problems in the United States. Infants and small children are particularly vulnerable to the effects of lead poisoning because lead can adversely affect the development of the brain and nervous system. No threshold for effects on children's IQ has been identified.

[97] The Ambient Water Quality Criteria FCV values were developed in the mid-1980's and distributed for public review. The values are compiled in the EcoTox Thresholds ECO Update (Volume 3 No. 2) (EPA, 1996)

31: Should Ecology include mercury on the PBT Working List?

In August 2000, Ecology proposed to focus on nine of the 12 chemicals/chemical groups identified by the Environmental Protection Agency in the national PBT strategy. Mercury was included on that initial list. Mercury was also one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal.

Ecology's review and analysis of public comments on Issue 31

Ecology believes that mercury should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, mercury meets the PBT criteria used by Ecology to prepare the PBT Working List:

  - *Persistence:* EPA (1998b) assigned a persistence score of three (greater than 580 hours) to mercury and mercury compounds. This is consistent with the range of soil half-life values (1.5 – 20 years) considered by EPA when deciding whether to include mercury among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a).

  - *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/ bioconcentration factors available for mercury and used a BAF value of 6,800,000 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioaccumulation factor included in the Mercury Report to Congress (EPA, 1997a). This value is considerably higher than the range of BCF values (7,000 – 36,000)[98] that EPA used when deciding whether to include mercury and mercury compounds among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a).

  - *Toxicity:* EPA (1998b) assigned scores of 3 for both human health and ecological toxicity. The human health score for non-cancer effects was based upon inhalation RfC value (0.0003 mg/m3)[99] published in the IRIS database. The ecological toxicity score was based on a Tier I Final Chronic Value (FCV) (0.0009081 mg/L) developed through the Great Lakes Water Quality Initiative [100], a Tier II Secondary Chronic Value (FCV)

[98] EPA (1999a) listed a range of BCF values (29,600 – 66,000) and a bioaccumulation factor for piscivorous fish (> 2,500,000)

[99] The RfD value was based on the results of a 60-week dog feeding study. The critical effect was increased liver-to-body weight ratios in males and females and 1000-fold uncertainty factor was applied to the LEL of 0.0125 mg/kg/day. EPA assigned a low level of confidence to the study and the RfD and a medium level of confidence to the database. (EPA, 2001a). Since 1998, the National Academy of Sciences (NAS, 2001a) has completed a review of the toxicological effects associated with mercury exposure and concluded that a RfD for methylmercury of 0.0001 mg/kg/day is a "scientifically justifiable level for the protection of public health." In July 2001, EPA updated the IRIS database to reflect these conclusions.

[100] The GLWQI values were derived using the same methods that EPA uses to derive ambient water quality criteria in cases where final residues values are not used. The source document for the Tier I FCV for cadmium is the Great

(0.0013 mg/L) developed through the Great Lakes Water Quality Initiative [101] and an AWQC FCV (0.0011 mg/L) developed by EPA's Office of Water.[102]

- *Uses, Releases, and Environmental Presence.* Mercury is a naturally occurring element and is found in a number products (e.g., thermometers, thermostats, fluorescent lights, preservatives, electrical switches, dental amalgams) and used in several manufacturing processes (e.g., production of chlorine gas and caustic soda). Many of these uses are being reduced or discontinued due to health concerns. Based on information in the National Toxics Inventory, an estimated 70,456 lbs of mercury are released into the air by Washington sources. In 1999, twenty Washington sources reported water discharges totaling 1183 lbs. Mercury has been found to be present in fish tissue (@ 99.9 percent of fish tissue samples collected by the Puget Sound Ambient Monitoring Program and analyzed for mercury have measurable levels of mercury) and in marine sediments (over 70 percent of marine sediment samples contained measurable amounts of mercury). Mercury has been identified as a parameter of concern for several waterbodies or segments included on the Washington 1998 303(d) list.

- *Program Consistency.* Mercury has been identified as a candidate substance for bans, phaseouts, and reductions (OME, 1993), a Level I substance under the Binational Toxics Strategy (GLNPO, 1997), one of the initial PBT chemicals identified by EPA (EPA, 1998b), a PBT chemical for purposes of promoting voluntary reductions under the Waste Minimization Plan (EPA, 1998d) and a PBT chemical for purposes of reporting under EPA's Toxics Release Inventory program (EPA, 1999a).

32: Should Ecology include methoxychlor on the PBT Working List?

Methoxychlor was one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. Ecology did not receive any specific comments on methoxychlor. However, the Department did receive comments from several individuals and organizations who recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

Ecology's review and analysis of public comments on Issue 32

Ecology believes that methoxychlor should be included on the PBT Working List. This conclusion is based on the following factors:

Lakes Water Quality Initiative Criteria Documents for the Protection of Aquatic Life in Ambient Water (EPA, 1995b).

[101] The GLWQI values were derived using the same methods that EPA uses to derive ambient water quality criteria in cases where final residues values are not used. The source document for the Tier I FCV for cadmium is the Great Lakes Water Quality Initiative Criteria Documents for the Protection of Aquatic Life in Ambient Water (EPA, 1995b).

[102] The Ambient Water Quality Criteria FCV values were developed in the mid-1980's and distributed for public review. The values are compiled in the EcoTox Thresholds ECO Update (Volume 3 No. 2) (EPA, 1996)

- *PBT Characteristics:* Based on available information, methoxychlor meets the PBT criteria used by Ecology to prepare the PBT Working List:

  – *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 2192 hours. This is consistent with the range of soil half-life values (1.5 – 20 years) considered by EPA when deciding whether to include methoxychlor among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a).

  – *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for methoxychlor and used a BCF value of 8128 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF database file. This value is identical to the value EPA used when deciding whether to include methoxychlor among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a). The value in the WMPT tables is also consistent with the range of BCF values currently included in EPA's EcoTox database (EPA, 2001b).

  – *Toxicity:* EPA assigned scores of 3 for based upon ecological toxicity. The ecological toxicity score was based upon the AWQC FCV (0.00003 mg/L) developed by EPA's Office of Water[103], a Tier II Secondary Chronic Value (SCV) (0.00002 mg/L) developed through the Great Lakes Water Quality Initiative [104] and an OPPT measured chronic data (0.0001 mg/L) that corresponds "a threshold concentration of a chemical in water at which statistically significant effects on an aquatic test population's survival, growth, or reproduction are expected to occur. EPA also assigned a human health (non-cancer) score of 2 based upon a chronic oral RfD value (0.005 mg/kg/day)[105] published in the IRIS database (EPA, 2001a).

- *Uses, Releases, and Environmental Presence.* Methoxychlor is an insecticide used to control a variety of insects (e.g., flies, mosquitoes, cockroaches, chiggers). It is used on agricultural crops, livestock, animal feed, grain storage, home gardens and on pets. Methoxychlor is currently registered for a variety of agricultural uses in Washington.[106] Information compiled by the Washington Agricultural Statistical Service (1999, 2000) indicate that methoxychlor was used in Washington for several food crops (e.g., apples, grapes) during the years 1997-1999. Methoxychlor has been found to be present in fish tissue (@ 4 percent of fish tissue

[103] The Ambient Water Quality Criteria FCV values were developed in the mid-1980's and distributed for public review. The values are compiled in the EcoTox Thresholds ECO Update (Volume 3 No. 2) (EPA, 1996)
[104] The GLWQI values were derived using the same methods that EPA uses to derive ambient water quality criteria in cases where final residues values are not used. The source document for the Tier I FCV for methoxychlor is the Great Lakes Water Quality Initiative Criteria Documents for the Protection of Aquatic Life in Ambient Water (EPA, 1995b).
[105] The RfD value was based on the results of a rabbit teratology study. The critical effect was excessive loss of litters and 1000-fold uncertainty factor was applied to the NOEL of 5.01 mg/kg/day. EPA assigned a low level of confidence to the study, the RfD and database. (EPA, 2001a)
[106] The crop profiles included on the Pesticide Information Center On-Line (PICOL) website include 19 entries for methoxychlor (Dr. Michael Norman, 2002, personal communication).

samples compiled in the Environmental Information Management system and analyzed for methoxychlor have measurable levels of methoxychlor) and other environmental media (@ 18 percent of environmental samples in the Environmental Information Management system analyzed for methoxychlor contained measurable amounts of methoxychlor).

- *Program Consistency.* Methoxychlor has been identified as a PBT chemical for purposes of promoting voluntary reductions under the Waste Minimization Plan (EPA, 1998d) and a PBT chemical for purposes of reporting under EPA's Toxics Release Inventory program (EPA, 1999a).

33: Should Ecology include pendimethalin on the PBT Working List?

Pendimethalin was one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. Ecology did not receive any specific comments on pendimethalin. However, the Department did receive comments from several individuals and organizations who recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

Ecology's review and analysis of public comments on Issue 33

Ecology believes that pendimethalin should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, pendimethalin meets the PBT criteria used by Ecology to prepare the PBT Working List:

  – *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 10,825 hours. This is consistent with conclusions reached by EPA in listing pendimethalin as a PBT chemical for purposes of reporting under the Toxics Release Inventory.[107] This is consistent with the range of soil half-life values compiled by EPA (1997a) during the reregistration process under the Food Quality Protection Act.[108]

  – *Bioaccumulation:* EPA (1998b) used a bioconcentration factor of 1949 to characterize the bioaccumulation potential of this substance. This is an estimated BCF value predicted using BCFWin (a bioconcentration factor estimation program developed by Syracuse Research Corporation). BCFWin estimates BCF values based on chemical structure and logKow values. This value is virtually identical to the value EPA used when deciding whether to include methoxychlor among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program

[107] EPA (1999a) stated that its "…conclusion that pendimethalin persists with a half-life greater than 6 months is based on a well-conducted study in which pendimethalin degrades in soil with a half-life of 1,322 days…"
[108] EPA (1997a) reported a range of aerobic soil metabolism half life values (42 – 1322 days) and used a value of 172 days for the purpose of exposure assessment.

(EPA, 1999a). The value in the WMPT tables is also consistent with the range of BCF values currently included in EPA's EcoTox database (EPA, 2001b) and EPA (1997a)[109].

– *Toxicity:* EPA (1998b) assigned a toxicity score of 3 based on ecological effects. The ecological toxicity score was based on information contained in the ACQUIRE database on acute and chronic effects. The chronic value 0.016 mg/L represents an LC50 (mortality) in a 30-day study with minnows. This chemical also received an eco-toxicity score of 3 based on an Aquatic Toxicity Reportable Quantity (RQ) of 10. For purposes of evaluating PBT chemicals, EPA assigned a low data preference to the ACQUIRE database and the Aquatic Toxicity RQ values. EPA (1997a) reviewed the available data on ecological impacts and concluded that technical pendimethalin is highly to moderately toxic to fish, freshwater aquatic invertebrates and marine/estuarine animals.[110]

- *Uses, Releases, and Environmental Presence.* EPA states that "…[p]endimethalin is a selective herbicide used to control broadleaf weeds and grassy weed species in a number of crop and non-crop areas and on residential lawns and ornamentals…" (EPA, 1997a). Pendimethalin is currently registered for a variety of agricultural and non-agricultural uses in Washington.[111] Information compiled by the Washington Agricultural Statistical Service (1999, 2000) indicate that pendimethalin was used in Washington for several food crops (e.g., lima beans, potatoes) during the years 1997-1999.

- *Program Consistency.* Pendimethalin has been identified as a PBT chemical for purposes of promoting voluntary reductions under the Waste Minimization Plan (EPA, 1998d) and a PBT chemical for purposes of reporting under EPA's Toxics Release Inventory program (EPA, 1999a).

34: Should Ecology include pentabromo diphenyl ether on the PBT Working List?

Pentabromo diphenyl ether was not one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. It was added to the Candidate PBT List because it had received a PBT score of 9. Ecology did not receive any specific comments on pentabromo diphenyl ether. However, the Department did receive comments from several individuals and organizations who recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

[109] EPA (1997a) reported that "…pendimethalin accumulated readily in bluegill sunfish with biological concentration factors of 1400X in edible, 5800X in non-edible and 5100Xin whole fish, however, depuration was rapid…"
[110] EPA (1997a) concluded that results indicate that aquatic invertebrate reproductive impairment and reproductive effects to freshwater fish may occur at concentrations greater 14.5 and 6.3 ug/L, respectively. Use of these values within the ecological toxicity scoring framework would result in a classification of high concern (Score = 3).
[111] The crop profiles included on the Pesticide Information Center On-Line (PICOL) website include 65 entries for pendimethalin (Dr. Michael Norman, 2002, personal communication).

Ecology's review and analysis of public comments on Issue 34

Ecology believes that pentabromo diphenyl ether should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, pentabromo diphenyl ether meets the PBT criteria used by Ecology to prepare the PBT Working List:

  – *Persistence:* EPA (1998c) used the EQC multi-media model to estimate a regional half-life of 2724 hours.

  – *Bioaccumulation:* EPA (1998c) used a BCF value of 8128 to characterize the bioaccumulation potential of this substance. This is an estimated BCF value predicted using BCFWin (a bioconcentration factor estimation program developed by Syracuse Research Corporation). BCFWin estimates BCF values based on chemical structure and logKow values.

  – *Toxicity:* EPA assigned a toxicity score of 3 based on ecological effects. The ecological toxicity score was based on acute (0.0000102 mg/L (mysid shrimp) and chronic (0.000642 mg/L (fish)) ECOSAR values. For purposes of evaluating PBT chemicals, EPA assigned a lowest data preference to ECOSAR values. EPA also assigned a human health (non-cancer) score of 2 based upon a chronic oral RfD value (0.002 mg/kg/day)[112] published in the IRIS database (EPA, 2001a).

- *Uses, Releases, and Environmental Presence:* Pentabromo diphenyl ether is used in Washington State and is present in Washington's environment. This compound belongs to a class of compounds (poly-brominated diphenyl ethers (PBDEs)) that are commonly used as flame retardants in various plastic products. Johnson and Olson (2001) have found pentabromo diphenyl ether concentrations in fish tissue ranging from 1.4 to 650 ug/kg wet weight.

- *Program Consistency:* The Organization for Economic Cooperation and Development (OECD) and the Paris Commission for the Prevention of Marine Pollution are developing strategies for restricting and phasing out the use of various polybrominated dipheny ethers (including pentabromo diphenyl ether).

35: Should Ecology include pentachlorobenzene on the PBT Working List?

Pentachlorobenzene was one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. Ecology did not receive any specific comments on pentachlorobenzene. However, the Department did receive comments from several individuals and organizations who recommended that Ecology limit the PBT

[112] The RfD value was based on the results of a subchronic rat feeding study. The critical effect was liver and kidney and 10000-fold uncertainty factor was applied to the LOAEL of 8.3 mg/kg/day. EPA assigned a medium level of confidence to the study and a low level of confidence to the RfD and the database. (EPA, 2001a)

Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

Ecology's review and analysis of public comments on Issue 35

Ecology believes that pentachlorobenzene should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, pentachlorobenzene meets the PBT criteria used by Ecology to prepare the PBT Working List:

  – *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 3656 hours. This is consistent with the range of soil half-life values (1.5 – 20 years) considered by EPA when deciding whether to include pentachlorobenzene among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a).

  – *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/ bioconcentration factors available for pentachlorobenzene and used a BCF value of 8314 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF database file. This value is virtually identical to the value EPA used when deciding whether to include pentachlorobenzene among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a).

  – *Toxicity:* EPA assigned scores of 3 for ecological toxicity. The ecological toxicity score was based on a Tier II Secondary Chronic Value (SCV) (0.0005 mg/L) developed through the Great Lakes Water Quality Initiative.[113]

- *Uses, Releases, and Environmental Presence.* Pentachlorobenzene is a degradation by-product of pentanitrochlorobenzene and is a trace contaminant in several pesticide formulations that are used in Washington.[114]

- *Program Consistency.* Pentachlorobenzene has been identified a Level II substance under the Binational Toxics Strategy (GLNPO, 1997), a PBT chemical for purposes of promoting voluntary reductions under the Waste Minimization Plan (EPA, 1998d) and a PBT chemical for purposes of reporting under EPA's Toxics Release Inventory program (EPA, 1999a).

[113] The GLWQI values were derived using the same methods that EPA uses to derive ambient water quality criteria in cases where final residues values are not used. The source document for the Tier I FCV for cadmium is the Great Lakes Water Quality Initiative Criteria Documents for the Protection of Aquatic Life in Ambient Water (EPA, 1995b).

[114] Hexachlorobenzene and pentachlorobenzene have been identified as a minor impurities in several pesticides including chorothalonil, dacthal, picloram, pentanitrochlorobenzene, endosulfan, clopyrilid, simazine, atrazine, chlorpyrifos-methyl (Smith, 1998). Smith estimated that dietary cancer risks associated with these pesticide impurities are approximately 10-6. Interpretation of these results is complicated by the large number on non-detect values.

36: Should Ecology include pentachloronitrobenzene on the PBT Working List?

Pentachloronitrobenzene was one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. Ecology did not receive any specific comments on pentachloronitrobenzene. However, the Department did receive comments from several individuals and organizations who recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

Ecology's review and analysis of public comments on Issue 36

Ecology believes that pentachloronitrobenzene should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, pentachloronitrobenzene meets the PBT criteria used by Ecology to prepare the PBT Working List:

  - *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 6654 hours.

  - *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for pentachloronitrobenzene and used a BCF value of 1122 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF database file.

  - *Toxicity:* EPA (1998b) assigned a toxicity score of 3 based on ecological effects. The ecological toxicity score was based on information contained in the ACQUIRE database on acute effects. The acute value 0.01 mg/L represents an LC50 (mortality) in a 4-day study with opossum shrimp. This chemical also received an ecological toxicity score of 3 based on acute (0.01 mg/L (mysid shrimp) and chronic (0.065 mg/L (fish)) ECOSAR values. For purposes of evaluating PBT chemicals, EPA assigned a low data preference to the ACQUIRE database and a lowest data preference to ECOSAR values.

- *Uses, Releases, and Environmental Presence.* PCNB is used as a fungicide for seed and soil treatment, herbicide, to prevent slime buildup in industrial waters. Based on information in the National Toxics Inventory, it is estimated that a small amount of pentanitrochlorobenzene is being used and released (< 1 lb/year) into the air by Washington sources.

- *Program Consistency.* Pentachloronitrobenzene has been identified a PBT chemical for purposes of promoting voluntary reductions under the Waste Minimization Plan (EPA, 1998d).

37: Should Ecology include polyaromatic hydrocarbons (PAHs) on the PBT Working List?

The August draft strategy focused on nine of the 12 chemicals/groups of chemicals identified by the Environmental Protection Agency in the national PBT strategy. One of the identified chemicals was benzo(a)pyrene. In the January proposed strategy, benzo(a)pyrene and several other PAH compounds were included on the Candidate list. One individual recommended that Ecology remove B(a)P from the PBT list:

A notable feature of B(a)P and other PAHs is that they are metabolized extensively in vertebrates, including fishes. Metabolism of PAHs results in conversion of a hydrophobic compound into polar, water soluble forms that are readily excreted. Consequently, PAHs do not biomagnify. While some invertebrates (such as shellfish) do not metabolize PAHs, they do not biomagnify these compounds either. Rather there body tissue levels accumulate and release PAHs in accordance with the availability in their food supply[115]…..Ecology should drop B(a)P from its PBT list because it does not biomagnify….(Loehr, pp. 3-4)

It was also recommended that Ecology take into account information on the relative bioavailability of various forms of benzo(a)pyrene:

The PBT strategy fails to recognize that PAHs including B(a)P might be present in different forms, some of which are not bioavailable. Not all forms of PAHs are equally available. For example, PAHs associated with coal particles or charcoal briquettes may have much lower availabilities than PAHs associated with fuel and oils. (Loehr, p. 6)

Ecology's review and analysis of public comments on Issue 37

Ecology has reviewed the comments on this issue and continues to believe that benzo(a)pyrene and other PAH compounds should be included on the Washington list of PBT chemicals. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, PAHs meet the PBT criteria used by Ecology to prepare the PBT Working List:
  - *Persistence:* EPA (1998b) used the EQC multi-media model to estimate regional half-lifes for several PAH compounds that ranged from 586 to 24652 hours. This is consistent with the range of soil half-life values (20 days – 14.6 years) considered by EPA when deciding whether to include several dioxin and dioxin-like compounds among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a).
  - *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for several PAH compounds and used a range of BAF/BCF values from 602 to 25,703 to characterize the bioaccumulation potential of

[115] To support his recommendations, Mr. Loehr provided a recent review of the National Mussel Watch program in which NOAA scientists concluded that "…concentrations of PAHs in mussels and oysters represent relatively recent exposure to petroleum hydrocarbons, either from spills, runoff or combustion sources."

this substance. Most of these values are based on a measured bioconcentration factors included in the Syracuse Research Corporation BCF database file. The value for fluoranthene represents a measured BAF value included in the HWIR database. The value for benzo (g, h, i) perylene is an estimated BCF value predicted using BCFWin (a bioconcentration factor estimation program developed by Syracuse Research Corporation). BCFWin estimates BCF values based on chemical structure and logKow values. This range of value is consistent with the range of BCF values[116] considered by EPA when deciding whether to include various PAH compounds among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a).

– *Toxicity:* EPA (1998b) developed human health and ecological toxicity scores for several PAH compounds. For benzo[a]yrene, EPA assigned scores of 3 for both human health and ecological toxicity. The human health score for non-cancer effects was based upon an oral RfD value (0.0005 mg/kg/day) published in the IRIS database. With respect to cancer effects, EPA assigned a human health score of 3 based on the oral cancer slope factor (7.3 (mg/kg/day)-1) published in the IRIS database (EPA, 2001a).[117] The ecological toxicity score was based on an AWQC FCV (0.000001 mg/L) developed by EPA's Office of Water[118] and Tier II SCV (0.00001 mg/L) developed as part of the Great Lakes Water Quality Initiative.

- *Uses, Releases, and Environmental Presence.* PAHs are a group of over a hundred different chemicals that are formed during the incomplete burning of coal, oil, gas, garbage, etc. PAHs are also found in coal tar, creosote, roofing tar and are used in several medicines, personal care products, dyes, plastics, and pesticides. Based on information in the National Toxics Inventory, an estimated 221,938 lbs of PAHs are released into the air by Washington sources. In 1999, seven Washington sources reported water discharges totaling 50,110 lbs. PAHs have been found to be present in marine sediments (over 55 percent of marine sediment samples analyzed for PAH compounds contained measurable amounts of PAHs) and other environmental media (over 85 percent of environmental samples compiled in the Environmental Information Management database that were analyzed for PAH compounds contained measurable amounts of PAHs). PAHs have been identified as a parameter of concern for several waterbodies or segments on the Washington 1998 303(d) list.

- *Program Consistency.* One or more PAH compounds have been identified as candidate substances for bans, phaseouts, and reductions (OME, 1993), as Level I or II substances under the Binational Toxics Strategy (GLNPO, 1997), as one of the initial PBT chemicals identified by EPA (EPA, 1998a), as PBT chemicals for purposes of promoting voluntary reductions under the Waste Minimization Plan (EPA, 1998d) and as PBT chemicals for purposes of reporting under EPA's Toxics Release Inventory program (EPA, 1999a).

[116] EPA identified 22 polycyclic aromatic compounds as PBT chemicals. BCF values ranged from 800 to 28,620.
[117] Benzo[a]pyrene is classified as a probable human carcinogen (B2) based on sufficient evidence of carcinogenicity in animals [This is equivalent to "known/likely" category reflected in the1996 proposed revisions to the Agency's carcinogen classification system (EPA, 1996). To date, EPA has not issued final revised cancer guidelines.] The cancer slope factor represents a geometric mean of four slope factors obtained by different modeling procedures using the results from several oral bioassays with rats and mice (EPA, 2001a)
[118] The Ambient Water Quality Criteria FCV values were developed in the mid-1980's and distributed for public review. The values are compiled in the EcoTox Thresholds ECO Update (Volume 3 No. 2) (EPA, 1996)

38: Should Ecology include polychlorinated biphenyls (PCBs) on the PBT Working List?

In August 2000, Ecology proposed to focus on nine of the 12 chemicals/chemical groups identified by the Environmental Protection Agency in the national PBT strategy. PCBs were included on that initial list. PCBs were also one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. Ecology did not receive any specific comments on PCBs. However, the Department did receive comments from several individuals and organizations who recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

Ecology's review and analysis of public comments on Issue 38

Ecology believes that PCBs should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, PCBs meet the PBT criteria used by Ecology to prepare the PBT Working List:

  - *Persistence:* PCBs are a group (209 congeners/isomers) of organic chemicals, based on various substitutions of chlorine atoms on a basic bi-phenyl molecule. EPA (1998b) used the EQC multi-media model to estimate a regional half-life values ranging from 441 to 2578 hours for total PCBs and various Aroclors. This is consistent with the range of soil half-life values (1.5 – 20 years) considered by EPA when deciding whether to include PCBs among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a) and the range of values reported in EPA (2000a)[119].

  - *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for PCBs and used a BAF value of 29,494,339 to characterize the bioaccumulation potential of this substance. This value is based on a predicted bioaccumulation factor included in HWIR database. This value is consistent with the range of BCF and BAF values[120] considered by EPA when deciding whether to include PCBs among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a).

  - *Toxicity:* EPA (1998b) developed human health and ecological toxicity scores for total PCBs, various Aroclors and several specific PCB congeners. With respect to total PCBs, EPA assigned scores of 3 for both human health and ecological toxicity. The human health score for non-cancer effects was based upon oral RfD value (0.00007 mg/kg/day)

[119] EPA (2000a) states that "…PCBs are among the most stable organic compounds known, and chemical degradation rates in the environment are thought to be slow…" (p. 548)

[120] EPA identified PCBs and eleven individual PCB congeners as PBT chemicals. BCF values ranged from 4,922 to 196,900. BAF values ranged from > 200,000 to > 141,000,000.

published in the HEAST database. The ecological toxicity score was based on an AWQC FCV (0.00001 mg/L) developed by EPA's Office of Water.[121] With respect to cancer effects, EPA assigned a human health score of 2 based on the oral cancer slope factor (2 (mg/kg/day)-1) published in the IRIS database (EPA, 2001a).[122]

- *Uses, Releases, and Environmental Presence.* PCBs have been used for a wide range of purposes because of insulating properties (e.g., insulation for electrical wires and cables, coolant and lubricant in transformers, capacitors, and lighting ballasts). PCBs are currently found in transformers and capacitors manufactured before EPA banned the production and most uses of PCBs in 1977. Based on information in the National Toxics Inventory, small amounts of PCBs (an estimated 24 lbs/yr) are released into the air by Washington sources. PCBs have been found to be present in fish tissue (@ 84 percent of fish tissue samples collected by the Puget Sound Ambient Monitoring Program and analyzed for PCBs have measurable levels of PCBs) and in marine sediments (@ 36 percent of marine sediment samples contained measurable amounts of PCBs). PCBs have been identified as a parameter of concern for listing several waterbodies or segments on the Washington 1998 303(d) list.

- *Program Consistency.* PCBs have been identified as candidate substances for bans, phaseouts, and reductions (OME, 1993), Level I substances under the Binational Toxics Strategy (GLNPO, 1997), one of the initial PBT chemicals identified by EPA (EPA, 1998a), PBT chemicals for purposes of reporting under EPA's Toxics Release Inventory program (EPA, 1999a) and a persistent organic pollutant (POPs) by the United Nations Environmental Program (UNEP, 2001).

39: Should Ecology include 1,2,4,5-Tetrachlorobenzene on the PBT Working List?

1,2,4,5-Tetrachlorobenzene was one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. Ecology did not receive any specific comments on 1,2,4,5-tetrachlorobenzene. However, the Department did receive comments from several individuals and organizations who recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

Ecology's review and analysis of public comments on Issue 39

Ecology believes that 1,2,4,5-tetrachlorobenzene should be included on the PBT Working List. This conclusion is based on the following factors:

[121] The Ambient Water Quality Criteria FCV values were developed in the mid-1980's and distributed for public review. The values are compiled in the EcoTox Thresholds ECO Update (Volume 3 No. 2) (EPA, 1996)
[122] PCBs are classified as a probable human carcinogen (B2) based on sufficient evidence of carcinogenicity in animals [This is equivalent to "known/likely" category reflected in the1996 proposed revisions to the Agency's carcinogen classification system (EPA, 1996). To date, EPA has not issued final revised cancer guidelines.] The cancer slope factor was calculated using a linear extrapolation below the LED10 value that was based on increased rates of liver carcinomas in rats. (EPA, 2001a)

- *PBT Characteristics:* Based on available information, 1, 2, 4, 5 tetrachlorobenzene meets the PBT criteria used by Ecology to prepare the PBT Working List:

  – *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 2393 hours.

  – *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for 1,2,4,5-Tetrachlorobenzene and used a BCF value of 4073 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF database file.

  – *Toxicity:* EPA (1998b) assigned scores of 3 for both human health and ecological toxicity. The human health score for non-cancer effects was based upon oral chronic RfD value (0.0003 mg/kg/day)[123] published in the IRIS database. The ecological toxicity score was information contained in the ACQUIRE database on acute effects and an acute ECOSAR values. With respect to the ACQUIRE database, the acute value (0.01 mg/L) represents an EC50 in a 2-day study with diatoms. This chemical also received an ecological toxicity score of 3 based on an acute ECOSAR values (0.028 mg/L (mysid shrimp)). For purposes of evaluating PBT chemicals, EPA assigned a low data preference to the ACQUIRE database and a lowest data preference to ECOSAR values.

- *Uses, Releases, and Environmental Presence.* 1,2,4,5-tetrachlorobenzene is a degradation byproduct of pentachlorobenzene and hexachlorobenzene and therefore may enter the environment as a result of the microbial degradation of these compounds. 1,2,4,5-tetrachlorobenzene has been found to be present in marine and freshwater sediments (approximately 4 percent of marine and freshwater sediment samples analyzed for 1,2,4,5-tetrachlorobenzene contained measurable amounts of this substance).

- *Program Consistency.* 1,2,4,5-tetrachlorobenzene has been identified as a Level II substance under the Binational Toxics Strategy (GLNPO, 1997) and a PBT chemical for purposes of promoting voluntary reductions under the Waste Minimization Plan (EPA, 1998d).

40: Should Ecology include toxaphene on the PBT Working List?

In August 2000, Ecology proposed to focus on nine of the 12 chemicals/chemical groups identified by the Environmental Protection Agency in the national PBT strategy. Toxaphene was

[123] The RfD value was based on the results of a 60-week dog feeding study. The critical effect was increased liver-to-body weight ratios in males and females and 1000-fold uncertainty factor was applied to the LEL of 0.0125 mg/kg/day. EPA assigned a low level of confidence to the study and the RfD and a medium level of confidence to the database. (EPA, 2001a). Since 1998, the National Academy of Sciences (NAS, 2001a) has completed a review of the toxicological effects associated with mercury exposure and concluded that a RfD for methylmercury of 0.0001 mg/kg/day is a "scientifically justifiable level for the protection of public health.". In July 2001, EPA updated the IRIS database to reflect these conclusions.

included on that initial list. Toxaphene was also one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal.

Ecology's review and analysis of public comments on Issue 40

Ecology believes that toxaphene should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, toxaphene meets the PBT criteria used by Ecology to prepare the PBT Working List:

  - *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 39,526 hours. This is consistent with the range of soil half-life values (1.5 – 20 years) considered by EPA when deciding whether to include toxaphene among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a).

  - *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/ bioconcentration factors available for toxaphene and used a BAF value of 40,000,000 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioaccumulation factor included in HWIR database. This value is consistent, but considerably higher, than the BCF value (34,050) that EPA used when deciding whether to include toxaphene among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a). The value in the WMPT tables is also consistent with the range of BCF values currently included in EPA's EcoTox database (EPA, 2001b).

  - *Toxicity:* EPA (1998b) assigned scores of 3 for both human health and ecological toxicity. The human health score for non-cancer effects was based upon a CESARs score of 10. The ecological toxicity score was based on an AWQC FCV (0.0000002 mg/L) developed by EPA's Office of Water[124], a Tier II Secondary Chronic Value (SCV) (0.00001 mg/L) developed through the Great Lakes Water Quality Initiative [125] and an OPPT measured chronic data (0.00035 mg/L) that corresponds "a threshold concentration of a chemical in water at which statistically significant effects on an aquatic test population's survival, growth, or reproduction are expected to occur. With respect to cancer effects, EPA assigned a human health score of 2 based on the oral cancer slope factor (1.1 (mg/kg/day)-1) published in the IRIS database (EPA, 2001a).[126]

[124] The Ambient Water Quality Criteria FCV values were developed in the mid-1980's and distributed for public review. The values are compiled in the EcoTox Thresholds ECO Update (Volume 3 No. 2) (EPA, 1996).
[125] The GLWQI values were derived using the same methods that EPA uses to derive ambient water quality criteria in cases where final residues values are not used. The source document for the Tier I FCV for cadmium is the Great Lakes Water Quality Initiative Criteria Documents for the Protection of Aquatic Life in Ambient Water (EPA, 1995b).
[126] Toxaphene is classified as a probable human carcinogen (B2) based on sufficient evidence of carcinogenicity in animals [This is equivalent to "known/likely" category reflected in the 1996 proposed revisions to the Agency's carcinogen classification system (EPA, 1996). To date, EPA has not issued final revised cancer guidelines.] The cancer slope factor was calculated using the linearized multistage procedure based on increased rates of hepatocellular carcinomas and neoplastic nodules in mice. (EPA, 2001a)

- *Uses, Releases, and Environmental Presence.* Toxaphene is an insecticide formerly used on livestock and various crops (e.g., soybeans). Toxaphene has been found to be present in various environmental media (@ 11 percent of environmental samples included in the Environmental Information Management database that have analyzed for toxaphene have measurable levels of this substance). Toxaphene has been identified as a parameter of concern for several waterbodies or segments included on the Washington 1998 303(d) list.

- *Program Consistency.* Toxaphene has been identified as a candidate substance for bans, phaseouts, and reductions (OME, 1993), a Level I substance under the Binational Toxics Strategy (GLNPO, 1997), one of the initial PBT chemicals identified by EPA (EPA, 1998a), a PBT chemical for purposes of reporting under EPA's Toxics Release Inventory program (EPA, 1999a) and a persistent organic pollutant (POPs) by the United Nations Environmental Program.

41: Should Ecology include trifluralin on the PBT Working List?

Trifluralin was one of the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" identified in Appendix E of the January 2001 proposal. Ecology did not receive any specific comments on trifluralin. However, the Department did receive comments from several individuals and organizations who recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue 2).

Ecology's review and analysis of public comments on Issue 41

Ecology believes that trifluralin should be included on the PBT Working List. This conclusion is based on the following factors:

- *PBT Characteristics:* Based on available information, trifluralin meets the PBT criteria used by Ecology to prepare the PBT Working List:

  – *Persistence:* EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 1635 hours. This is consistent with the range of soil half-life values (99 – 394 days) considered by EPA when deciding whether to include trifluralin among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a). This range of soil half-life values is consistent with the range reported in the Registration Evaluation Document for trifluralin (EPA, 1996).[127]

  – *Bioaccumulation:* EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for trifluralin and used a BCF value of 4168 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF

[127] EPA (1996) includes a range of soil half life values (29 – 201 days) (See pp. 39-40)

database file. This value is consistent with the value (5,674)[128] that EPA used when deciding whether to include trifluralin among the substances identified as PBT chemicals for purposes of reporting under the Toxics Release Inventory (TRI) program (EPA, 1999a). The value in the WMPT tables is also consistent with the range of BCF values currently included in EPA's EcoTox database (EPA, 2001b).

– *Toxicity:* EPA (1998b) assigned a toxicity score of 3 based on ecological effects. The ecological toxicity score was based on an Aquatic Toxicity RQ of 1 pound, information contained in the ACQUIRE database on acute effects and acute and chronic ECOSAR values. With respect to the ACQUIRE database, the acute value (0.01 mg/L) represents an LC50 (mortality) in a 4-day study with rainbow trout. This chemical also received an ecological toxicity score of 3 based on acute (0.421 mg/L (daphnid)) and chronic (0.003 mg/L (fish)) ECOSAR values. For purposes of evaluating PBT chemicals, EPA assigned a low data preference to the ACQUIRE database and a lowest data preference to ECOSAR values. This is consistent with EPA's (1996) conclusions in the Reregistration Eligibility Document for trifluralin.[129] EPA assigned a human health (non-cancer effects) score of 2 based on oral chronic RfD value (0.0075 mg/kg/day) published in the IRIS database (EPA, 2001a).[130]

- *Uses, Releases, and Environmental Presence.* Trifluralin is a pesticide used in the pre-emergent control of annual grasses and broadleaf weeds. It is currently used on soybeans, flowering shrubs, trees and golf courses. It is currently registered for a variety of agricultural and non-agricultural uses in Washington.[131] Information compiled by the Washington Agricultural Statistical Service (1999, 2000) indicates that trifluralin was used in Washington for several food crops during the years 1997-1999. Based on information in the National Toxics Inventory, an estimated 0.0005 lbs of trifluralin was released into the air by Washington sources. Trifluralin has been found to be present in fish tissue (@ 30 percent of fish tissue samples included in the Environmental Information Management database that have analyzed for trifluralin have measurable levels of this substance).

- *Program Consistency.* Trifluralin has been identified as a candidate substance for bans, phaseouts, and reductions (OME, 1993), a PBT chemical for purposes of promoting voluntary reductions under the Waste Minimization Plan (EPA, 1998d) and a PBT chemical for purposes of reporting under EPA's Toxics Release Inventory program (EPA, 1999a).

[128] This corresponds to the bioconcentration factor reported in EPA (1996) for whole fish tissue (blue gill sunfish). However, EPA (1996) noted several deficiencies in the study which the registrant was asked to address. The status of that response is not known.

[129] For example, EPA (1996) concluded that "…[t]he results of acute toxicity studies indicate that trifluralin is highly to very highly toxic to both cold and warmwater fish…" (p. 32). EPA (1996) also concluded that chronic effects in fish may occur from the use of trifluralin at levels as low as 5.1 ppb which is consistent with a high level of concern (ecological toxicity score = 3).

[130] The RfD value was based on the results of a 12 month dog feeding study. The critical effect was increased liver-to-body weight and increased methemoglobiin and 100-fold uncertainty factor was applied to the NOEL of 0.75 mg/kg/day. EPA assigned a high level of confidence to the study, the database and the RfD. (EPA, 2001a)

[131] The crop profiles included on the Pesticide Information Center On-Line (PICOL) website include 91 entries for trifluralin (Dr. Michael Norman, 2002, personal communication).

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V. Summary of Comments on Specific Chemicals Not Included on the PBT Working List and Ecology's Responses

42: Should Ecology include arsenic on the PBT Working List?

In August 2001, Ecology proposed to focus on nine of the 12 chemicals and chemical groups identified by the Environmental Protection Agency in the national PBT strategy. Citizen and environmental groups recommended that Ecology include all of the 27 substances (including arsenic) identified by the Ontario Ministry of the Environment (OME, 1993). For example:

As a matter of sound science, failing to use the full list of 27 chemicals which Ecology originally proposed makes no sense whatsoever. All of the chemicals on that list are widely accepted to be persistent, bioaccumulative, and highly toxic. Ignoring endosulfan, pentachlorophenol, cadmium, and the other now-missing PBTs will not make them go away in our environment and our children's lives. All PBTs need to be addressed, not just a handful. A chemical of the day approach fails to give our children and others the comprehensive protection they deserve. (Dansereau, p. 3)

In January 2001, Ecology proposed to move forward to identify and rank PBT chemicals using a four-step process. Arsenic was not included among the among the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" that Ecology proposed to evaluate using this process. The Department did not receive additional comments specifically addressing the question of whether to include arsenic on the PBT Working List.

Ecology's Review and Analysis of Public Comments on Issue 42:

Ecology has reviewed the comments received on this issue and has decided not to include arsenic on the PBT Working List. Arsenic is not included on the PBT Working List because the bioaccumulation the bioaccumulation factor for arsenic is well below the criterion used to assess bioaccumulation potential. Specifically, EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for arsenic and used a BAF value of 4 to characterize the bioaccumulation potential of this substance. This value is based on a measured BAF value included in the Hazardous Waste Identification Rule (HWIR) database.[132]

Ecology's decision not to include arsenic on the PBT Working List serves to illustrate an important point. Specifically, a substance can be a high priority for agency action (such is the case with arsenic) yet not display all of the properties that would justify including it on the PBT

[132] This value is consistent with the range of BCF values currently included in EPA's EcoTox database (EPA, 2001b). However, EPA (2000a) included arsenic on its list of important bioaccumulative chemicals (Table 4-2) and identified arsenic a metal with a "propensity to biomagnify".

Working List. While arsenic may have a low bioaccumulation potential, it still is highly toxic and continues to warrant attention under other state and federal environmental programs[133].

43: Should Ecology include bis (2-ethylhexyl) phthalate (BEHP) on the PBT Working List?

The draft list of candidate chemicals published in January 2001 included BEHP. The American Chemistry Council's Phthalate Esters Panel submitted extensive comments supporting their position that phthalates should not be listed as PBT chemicals:

The Panel … strongly believes the phthalates are not PBT chemicals and should be removed from the list of candidate chemicals. (Price, p. 1)

Ecology's Review and Analysis of Public Comments on Issue 43:

Ecology has reviewed the comments received on this issue and has decided not to include BEHP on the PBT Working List. The two main reasons why Ecology has elected not to include this substance on the PBT Working List are (1) The bioconcentration factor is below the criterion used to assess bioaccumulation potential[134]; and (2) Information made available subsequent to the 1998 release of the WMPT suggests that ecological toxicity values are above (less toxic) the criterion used to assess ecological toxicity[135].

[133] Arsenic has been identified as a high priority for action under several state and federal programs (e.g., cleanup, drinking water) because arsenic is classified as a known human carcinogen. This is consistent with the human health scores (3) assigned to arsenic for cancer and non-cancer health effects. Specifically, the human health score for cancer effects was based on the unit risk inhalation factor (0.0043 (ug/m3)-1) published in the EPA IRIS database. The IRIS unit risk inhalation factor is based on the results of several studies of increased cancer risk associated with workplace exposures. (EPA, 2001a). EPA has also published an oral cancer slope factor (1.5 (mg/kg/day)-1) based on increased rates of skin cancer among people exposed to high levels of arsenic in drinking water. This cancer slope factor falls below the value EPA used to assign a toxicity score of 3. However, subsequent to September 1998, the National Academy of Sciences has completed two reviews of arsenic toxicity (NAS, 2000, 2001b) and concluded that there is sufficient scientific evidence to support the conclusion that ingestion of arsenic also increases the risks of other types of cancer (e.g., lung, bladder, and liver). The human health score for non-cancer effects was based upon an oral Reference Dose (0.0003 mg/kg/day) published in the EPA IRIS Database and a Minimal Risk Level (0.0003 mg/kg/day) developed by the Agency for Toxics Substances and Disease Registry (ATSDR). Although, EPA has not revised the IRIS value, it is likely that a revised value would be at least 2 to 4 times higher than the current published value (See Morales, et al. 2000; EPA, 2000; NAS, 2001).

[134] EPA (1998c) evaluated the range of bioaccumulation factors/bioconcentration factors available for BEHP and used a BCF value of 851 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF database file. The value in the WMPT tables is consistent with the range of BCF values (1.6 to 107,670) currently included in EPA's EcoTox database (EPA, 2001b). The WMPT value falls in between the arithmetic mean (2520) and the median (297) calculated from the 89 measured values in the EPA database. The WMPT value corresponds to the 76th percentile value (@ 24 percent of the values in the EPA database were higher than 851).

[135] EPA (1998c) assigned an ecological toxicity score of 3 to BEHP. The ecological toxicity score was based on a Tier II SCV (0.032 mg/L) developed as part of the Great Lakes Water Quality Initiative. Subsequent to September 1998, industry-sponsored studies were completed which indicated that BEHP was not toxic to aquatic organisms at concentrations below its solubility limit (0.34 mg/L). EPA's Office of Water reviewed this information and modified the ambient water quality criterion for BEHP (EPA, 1999). The revised water quality criterion is above the ecological toxicity criterion used by Ecology to prepare the PBT Working List.

44: Should Ecology include 4-bromophenyl phenyl ether on the PBT Working List?

In January 2001, Ecology proposed to move forward to identify and rank PBT chemicals using a four-step process. 4-Bromophenyl phenyl ether was among the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" that Ecology proposed to evaluate using this process. Ecology did not receive any specific comments on 4-bromophenyl phenyl ether. However, the Department did receive comments from several individuals and organizations who recommended that Ecology limit the PBT Working List to PBT chemicals identified by EPA and the United Nations Environmental Program. Others urged Ecology to consider chemicals beyond those identified by federal and international organizations. (See Issue #2).

Ecology's Review and Analysis of Public Comments on Issue 44:

Ecology has reviewed the information underlying the persistence, bioaccumulation, and toxicity scores for 4-bromophenyl phenyl ether and has decided not to include this substance on the PBT Working List. The main reason Ecology decided not to include this substance on the initial PBT Working List was several questions regarding environmental persistence. Specifically, EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 602 hours for this substance. However, all of the media-specific half-live values used to develop the regional half-life value were predicted values. Given that the regional half–life value (602 hours) was only slightly above the persistence criterion (580 hours), Ecology elected to review this substance further before deciding whether to include it on the PBT Working List.

45: Should Ecology include butyl-benzyl phthalate on the PBT Working List?

The draft list of candidate chemicals published in January 2001 included butyl benzyl phthalate. The American Chemistry Council's Phthalate Esters Panel submitted extensive comments supporting their position that phthalates should not be listed as PBT chemicals:

The Panel … strongly believes the phthalates are not PBT chemicals and should be removed from the list of candidate chemicals. (Price, p. 1)

Ecology's Review and Analysis of Public Comments on Issue 45:

Ecology has reviewed the comments received on this issue and has decided not to include BBP on the PBT Working List. The two main reasons why Ecology has elected not to include this substance on the PBT Working List are (1) The regional half-life value is below the criterion used to assess persistence[136]; and (2) The bioconcentration factor is below the criterion used to assess bioaccumulation potential[137].

[136] EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 491 hours. Media-specific half-lives are also below criterion used by EPA and international agencies.

[137] EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for BBP and used a BCF value of 660 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF database file.

46: Should Ecology include dibutyl phthalate (DBP) on the PBT Working List?

The draft list of candidate chemicals published in January 2001 included DBP. The American Chemistry Council's Phthalate Esters Panel submitted extensive comments supporting their position that phthalates should not be listed as PBT chemicals:

The Panel … strongly believes the phthalates are not PBT chemicals and should be removed from the list of candidate chemicals. (Price, p. 1)

Ecology's Review and Analysis of Public Comments on Issue 46:

Ecology has reviewed the comments received on this issue and has decided not to include DBP on the PBT Working List. The main reason why Ecology has elected not to include this substance on the initial list is that the regional half-life value for DBP is well below the persistence criterion used by Ecology to prepare the PBT Working List. Specifically, EPA (1998c) used the EQC multi-media model to estimate a regional half-life of 195 hours. Media-specific half-lives are also below criterion used by EPA and international agencies.

47: Should Ecology include di-n-octyl phthalate on the Ecology PBT Chemical List?

The draft list of candidate chemicals published in January 2001 included di-n-octyl phthalate. The American Chemistry Council's Phthalate Esters Panel submitted extensive comments supporting their general position that phthalates should not be listed as PBT chemicals:

The Panel … strongly believes the phthalates are not PBT chemicals and should be removed from the list of candidate chemicals. (Price, p. 1)

Ecology's Review and Analysis of Public Comments on Issue 47:

Ecology has reviewed the comments on submitted by the Phthalates Esters Panel and decided not to include di-n-octyl phthalate on the initial PBT Working List. Although the persistence[138], bioaccumulation[139] and toxicity scores published for this substance exceed the criterion used by Ecology to prepare the initial PBT Working List, comments on provided by the American Chemistry Council (Phthalates Ester Panel) identified information and EPA interpretations of that information that led to several questions regarding the ecological toxicity scores. Specifically the Phthalate Esters Panel noted that EPA had previously removed di-n-octyl phthalate from the EPCRA Section 313 List of Toxic Chemicals in response to delisting petitions. They stated that EPA examined this chemical more closely to determine whether to

[138] EPA (1998c) used the EQC multi-media model to estimate a regional half-life of 1384 hours.
[139] EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for di-n-octyl phthalate and used a BCF value of 2400 to characterize the bioaccumulation potential of this substance. This value is based on a predicted bioaccumulation factor included in the technical support documents for the Hazardous Waste Identification Rule Risk Assessment.

continue to include it on the draft RCRA PBT List (EPA, 1998d) and then decided to remove di-n-octyl phthalate from the draft RCRA PBT List because data developed in response to the EPCRA delisting petition indicated that the human and ecological toxicity data were not conclusive. Ecology has decided to review this additional information before making a decision on whether to include this substance on the PBT Working List.

48: Should Ecology include nonyl-phenol on the PBT Working List?

Nonyl-phenol was among the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" that Ecology proposed to evaluate using this process. One commentor argued that it was inappropriate to include nonyl-phenol on this list:

As part of its PBT reduction strategy, the Department of Ecology has selected 65 candidate chemicals for PBT screening and prioritization, including nonyl-phenol (CASRN 25154=52-3). NP is neither persistent nor bioaccumulative and should not be identified on Washington State's candidate PBT list. In the attached document, APERC presents its concerns regarding the following issues, which are related to the listing of NP on Washington's proposed PBT candidate list:

EPA's draft Waste Management Prioritization Tool (WMPT) should not be used as the basis for selecting candidate chemicals for Washington's PBT list;
Available scientific data demonstrate that NP is neither persistent nor bioaccumulative; NP does not meet international criteria for PBT chemicals;
Since NP is not persistent or bioaccumulative, its environmental presence, quantity or prevalence in Washington State is irrelevant to its status under the PBT strategy. (Fensterheim, pp. 1-2)

Another commentor appeared to support inclusion of nonyl-phenol on the PBT list and expressed concerns that inadequate consideration of non-point sources would result in it being removed from further consideration:

Another significant non-point source is ingredients or breakdown products from household or other products disposed in wastewater. Nonyl-phenol is a partial decomposition product of widely used nonyl-phenol ethoxylate detergents…. (Rice and Dickey, p.2)

Ecology's Review and Analysis of Public Comments on Issue 48:

Ecology has reviewed the comments received on this issue and has decided not to include nonyl-phenol on the PBT Working List. The two main reasons why Ecology has elected not to include this substance on the PBT Working List are (1) The regional half-life value is below the criterion used to assess persistence[140]; and (2) The bioconcentration factor is below the criterion used to assess bioaccumulation potential[141].

[140] EPA (1998b) used the EQC multi-media model to estimate a regional half-life of 273 hours. The media-specific half-lives are also well below persistence criteria used by EPA and international agencies to identify PBT chemicals.
[141] EPA (1998b) evaluated the range of bioaccumulation factors/bioconcentration factors available for nonyl-phenol and used a BCF value of 550 to characterize the bioaccumulation potential of this substance. This is an estimated

49: Should Ecology include pentachlorophenol on the PBT Working List?

In August 2001, Ecology proposed to focus on nine of the 12 chemicals/chemical groups identified by the Environmental Protection Agency in the national PBT strategy. Citizen and environmental groups recommended that Ecology expand the "Starter List" to include pentachlorophenol. For example:

As a matter of sound science, failing to use the full list of 27 chemicals which Ecology originally proposed makes no sense whatsoever. All of the chemicals on that list are widely accepted to be persistent, bioaccumulative, and highly toxic. Ignoring endosulfan, pentachlorophenol, cadmium, and the other now-missing PBTs will not make them go away in our environment and our children's lives. All PBTs need to be addressed, not just a handful. A chemical of the day approach fails to give our children and others the comprehensive protection they deserve. (Dansereau, pp. 3)

In January 2001, Ecology proposed to move forward to identify and rank PBT chemicals using a four-step process. Pentachlorophenol was among the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" that Ecology proposed to evaluate using this process. One commentor argued that it was inappropriate to include pentachlorophenol on this list.

Ecology's Review and Analysis of Public Comments on Issue 49:

Ecology has reviewed the comments on this issue and decided not to include pentachlorophenol on the PBT Working List. This conclusion was reached after considering both (1) the available information on persistence[142], bioaccumulation[143] and toxicity[144] and (2) the criteria being used to prepare the PBT Working List. In particular, the BCF value for pentachlorophenol used by EPA (1998c) is less than the criteria (BAF/BCF > 1000) used to prepare the PBT Working List.

BCF value predicted using BCFWin (a bioconcentration factor estimation program developed by Syracuse Research Corporation). BCFWin estimates BCF values based on chemical structure and logKow values. .

[142] EPA (1998c) used the EQC multi-media model to estimate a regional half-life of 868 hours.

[143] EPA (1998c) evaluated the range of bioaccumulation factors/bioconcentration factors available for pentachlorophenol and used a BCF value of 776 to characterize the bioaccumulation potential of this substance. This value is based on a measured bioconcentration factor included in the Syracuse Research Corporation BCF database file. The value in the WMPT tables is consistent with the range of BCF values (5 to 45,000) currently included in EPA's EcoTox database (EPA, 2001b). The WMPT value falls in between the arithmetic mean (2218) and the median (137) calculated from the 98 measured values in the EPA database. The WMPT value roughly corresponds to the 75th percentile value (@ 25 percent of the values in the EPA database were higher than 776).

[144] EPA assigned a score of 3 for ecological toxicity. The ecological toxicity score is based on a Tier I Final Chronic Value (FCV) (0.004049 mg/L) developed through the Great Lakes Water Quality Initiative and an AWQC FCV (0.0079 mg/L) developed by EPA's Office of Water. EPA also assigned a human health score of 2 for non-cancer and cancer effects. The score for non-cancer effects was based upon an oral RfD value (0.03 mg/kg/day) published in the IRIS database (EPA, 2001a). The human health score for cancer effects was based on the oral cancer slope factor (0.12 (mg/kg/day)-1) published in the IRIS database (EPA, 2001a).

50: Should Ecology include polystyrene on the PBT Working List?

In January 2001, Ecology proposed to move forward to identify and rank PBT chemicals using a four-step process. Polystyrene was among the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" that Ecology proposed to evaluate using this process. One commentor stated that it was inappropriate to include polystyrene on this list.

Ecology's Review and Analysis of Public Comments on Issue 50:

Ecology has reviewed the comments on this issue and has decided not to include polystyrene should on the PBT Working List because the chemical does not meet the criteria that Ecology is proposing to use to select chemicals for inclusion on the PBT Working List. Specifically, polystyrene has a regional half-life less than 580 hours. This approach is consistent with other federal and international agencies that have generally not included polystyrene on their lists of PBT chemicals.

51: Should Ecology include vanadium on the PBT Working List?

In January 2001, Ecology proposed to move forward to identify and rank PBT chemicals using a four-step process. Vanadium was among the 66 chemicals/chemical groups identified as "Candidate PBT Chemicals" that Ecology proposed to evaluate using this process. One commentor argued that it was inappropriate to include vanadium on this list:

….vanadium is among the chemicals that are to be screened and prioritized under the PBT strategy. Vanadium may have been placed on the review list partly because in January 1999, EPA proposed to identify vanadium and vanadium compounds as PBT chemicals for purposes of the Toxics Release Inventory ("TRI") program. However, EPA did not identify vanadium as a PBT chemical in the final rule. The Department should not do so either – because, even if the WMPT-based methodology could appropriately be applied to metals, vanadium could not fairly be described as bioaccumulative…..In sum, even if the PBT methodology reflected in the September 1998 version of EPA's WMPT could appropriately be applied to metals (which it cannot), the identification of vanadium as a PBT chemical would be scientifically unjustified. This is another example of why application of the WMPT-based PBT methodology to metals is problematic. (King, p. 3)[145]

[145] King continued by stating that "…[I]n the proposed TRI rule, EPA identified BCF values of 100,000 to 1,000,000 for vanadium and vanadium compounds. These were described as measured values reported in Biggs and Swinehart (1976). However, as a complete reading of Biggs and Swinehart (1976) makes clear, these reported BCF values are not an appropriate basis for identifying vanadium and vanadium compounds as PBT chemicals, because the BCF of 100,000 to 1,000,000 is not an indicator of toxicological hazard."

Ecology's Review and Analysis of Public Comments on Issue 51:

Ecology has reviewed the comments received on this issue and has decided not to include vanadium on the PBT Working List. There are two main reasons why Ecology decided not to include this substance on the initial list: (1) questions remain on bioaccumulation potential and (2) EPA has announced plans to develop an agency-wide approach for evaluating metals. With respect to bioaccumulation potential, information submitted during the public comment period raised questions on whether vanadium meets the criteria being used by Ecology to evaluate bioaccumulation potential. In addition, recent EPA publications have not identified vanadium or vanadium compounds as bioaccumulative.[146] Ecology has decided to review available information and gain a better understanding of the determinations by other EPA programs (including any new methods for evaluating metals) before making a decision on whether to include this substance on the PBT Working List.

[146] For example, EPA proposed to identify vanadium and vanadium compounds as PBT chemicals for purposes of the Toxics Release Inventory ("TRI") program. However, EPA did not identify vanadium as a PBT chemical in the final rule..." (64 FR 58666 at 58671). In addition, vanadium was not identified as an "Important Bioaccumulative Chemical" in bioaccumulation guidance materials published by EPA (2000a)

VI. Summary of Comments on Chemical Ranking and Ecology's Responses

The January 2001 proposal included a two-step process[147] for ranking and prioritizing the chemicals appearing on the PBT Working List that addressed two fundamental questions:

- *Chemical Ranking:* Ecology proposed to rank the chemicals on the PBT Working List based on PBT Characteristics, Environmental Presence and Source Releases. This ranking is designed to provide a rough ordering of the seriousness of the hazards posed by these chemicals in Washington State (e.g., what are the biggest problems?); and

- *Prioritization:* Ecology proposed to prioritize the chemicals on the PBT Working List based on the chemical rankings, opportunities for reductions, costs and other factors. This prioritization is designed to provide a rough guide on resource allocation decisions (e.g., how much more or less desirable is it to allocate agency resources to one chemical or the other?).

Although the majority of comments on the January 2001 proposal focused on the criteria for including chemicals on the PBT Working List, several individuals and organizations provided comments on the proposed ranking framework. Ecology's evaluation and response to public comments on the ranking methodology included:

- Ecology tested the proposed ranking framework using available information on environmental for the 66 Candidate PBT chemicals identified in the January 2001 proposal.

- Ecology reviewed and evaluated the public comments received on the proposed ranking framework. Ecology's analysis and responses are summarized in this section of the Responsiveness Summary;

- Ecology modified the ranking framework described in January 2001 proposal after considering the preliminary ranking results, public comments and the amount of data available for the 22 chemicals and chemicals included on the PBT Working List. Modifications include:
  - Revised relative weights for the three ranking factors (PBT Characteristics (50%), Environmental Presence (25%) and Source Releases (25%));
  - Revised methodology for assigning points for PBT Characteristics; and
  - Revised methodology for assigning points for Source Releases (formerly Quantity/Prevalence).

- Ecology used the revised ranking framework to place the 22 chemicals/chemical groups included on the PBT Working List into one of three categories[148] (i.e., high, mid-range and low) corresponding to their relative rankings. The ranking results are summarized in Table 6.

[147] The proposed ranking framework represents a modified version of the chemical ranking methodology (RTI, 1998) prepared as part of EPA's efforts to implement the Waste Minimization National Plan (EPA, 1995b).

Table 6. Preliminary PBT Chemical Ranking Results

(Listed in Alphabetical Order by Category)

High	Mid-Range	Low
Cadmium Dioxins/Furans Hexachlorobenzene Lead Mercury Polynuclear Aromatic Hydrocarbon (PAH) Compounds Polychlorinated Biphenyls (PCBs)	Aldrin/Dieldrin DDT/DDE/DDD Chlordane Heptachlor epoxide Hexachlorobutadiene Hexachlorocyclohexane (Lindane) Pentachlorobenzene / Pentachloronitrobenzene Trifluralin	Dicofol Endosulfan (alpha/beta) Methoxychlor Pentabromo diphenyl ether Pendimethalin 1,2,4,5 Tetrachlorobenzene Toxaphene

52: Does the proposed ranking framework take into account an appropriate range of ranking factors?

Ecology proposed to rank the chemicals on the PBT Working List based on PBT characteristics, environmental presence and source releases. Under the Ecology proposal, the three factors were assigned equal weights (i.e., each factor could receive a maximum equal to one third of the overall maximum score). The public comments on the January 2001 proposal appeared to reflect general support for considering all three factors when ranking the chemicals that appear on the PBT Working List.

Ecology's Review and Analysis of Public Comments on Issue 52

Ecology has reviewed the comments on this issue and continues to believe that any ranking framework must take into account the three factors (PBT characteristics, environmental concentrations and source releases) when ranking the chemicals appearing on the PBT Working List. However, several individuals and organizations expressed concerns about the relative weights assigned to the three factors and the choice of indicators used to characterize each factor. These issues and changes made in response to public comments are discussed below.

[148] Ecology concluded that it would be inappropriate to make fine distinctions in the rankings for individual chemicals given the existence of large data gaps for some chemicals and some ranking factors. Consequently, Ecology elected to divide the chemicals into three groups that roughly correspond to how frequently the chemical has been found in Washington's environment and/or released by Washington sources. The seven chemicals or chemical groups included in high frequency group appear near the top of the ranked list independent of the relative weights assigned to PBT characteristics, environmental presence and source releases. In addition, mercury was generally the highest ranked chemical independent of the relative weights assigned to the three main ranking factors.

53: Does the proposed ranking framework provide a reasonable approach for assigning points for PBT Characteristics?

In January 2001, Ecology proposed to assign points for PBT characteristics based on the PBT scores published in the Waste Management Prioritization Tool (EPA, 1998b). For purposes of ranking, Ecology proposed that chemicals with a PBT score of seven (7) would be assigned zero points, those with a score of 8 would be assigned 1.5 points and those with a score of 9 would be assigned 3 points.

Ecology did not receive specific comments on the proposed used of the WMPT scores for ranking and the proposed system for assigning points (0, 1.5 and 3). However, in response to comments on the listing criteria, Ecology elected not to include chemicals with PBT scores of 7 or 8 on the Washington PBT Working List. The decision to exclude these chemicals from the PBT Working List required Ecology to revisit the issue of how to assign points for PBT Characteristics. After reviewing this issue, the Department decided to use a modified method for assigning points for PBT Characteristics for purposes of preparing the chemical rankings. There were two main reasons behind the decision to use a modified system:

- *Accounting for Variability in PBT Characteristics:* There are wide variations in the persistence, bioaccumulation potential and toxicity characteristics of chemicals appearing on the PBT Working List. For example, BAF/BCF values for chemicals appearing on the PBT Working List ranged from 1,122 to 40,000,000. The use of the January 2001 framework would mask this variability and complicate efforts to allocate resources in ways that achieve the greatest environmental gains.

- *Weighting Factors:* Use of the January 2001 framework would result in all of the chemicals on the PBT Working List being assigned 3 points for PBT Characteristics. This would have the practical effect of reducing the relative weight assigned to PBT Characteristics (for purposes of ranking) to zero. As discussed under Issue 54, several individuals were concerned that the January 2001 proposal already assigned an insufficient amount of weight (i.e., 33 percent) to this factor.

- *Consideration of New Scientific Information:* Use of the modified point system enabled Ecology to consider readily available information that has become available since 1998 (e.g., review of oral reference dose values available in the Integrated Risk Information System).

The modified point system has been modeled on the methodology used by EPA to develop the original PBT scores. Developing the modified point system involved the following steps:

- *Data Compilation:* The available information for persistence (regional half-life), bioaccumulation potential (BAF/BCF values), non-cancer[149] human health effects

[149] Ecology decided to assign points for human health toxicity based on non-cancer effects. Reference dose values (or surrogate measures) were available for all of the chemicals/chemical groups appearing on the PBT Working List. In contrast, cancer slope factors were available for only eight of the chemicals/chemical groups appearing on the list.

(oral reference dose) and ecological toxicity for each of the 22 chemicals/chemical groups included on the PBT Working List was compiled, entered into a spreadsheet format and then rank-ordered based on the particular ranking factor (e.g., BAF/BCF);

- *Assigning Points:* The four-rank ordered lists were used to assign points for persistence, bioaccumulation potential, human health toxicity, and ecological toxicity. For each chemical or chemical group, scores of 1, 2 or 3 were assigned for each of the four factors using a 1:1:1 scoring distribution. For example, the chemicals with regional half life values in the upper 33rd percentile were assigned 3 points for persistence, the chemicals with regional half life values in the middle 33rd percentile were assigned 2 points for persistence, and the chemicals in the lower 33rd percentile were assigned 1 point for persistence.

- *Human Health:* For each chemical or chemical group, a human health point total was calculated by summing the points for persistence, bioaccumulation, and human health toxicity. As shown in Table 7, point totals for human health ranged from 3 to 9 points.

- *Ecological Toxicity:* For each chemical or chemical group, an ecological toxicity point total was calculated by summing the points for persistence, bioaccumulation, and ecological toxicity. As shown in Table 7, point totals for ecological toxicity ranged from 3 to 9 points.

Ecology prepared chemical rankings using the modified point system and compared the ranking results with the ranking results obtained using the January 2001 framework (all chemicals assigned 3 points for PBT Characteristics). Key observations include:

- *Chemicals Assigned to "High" Category:* In general, the choice of scoring option does not appear to influence which chemicals or chemical groups are included in the High category. Specifically, the same seven chemicals/chemical groups consistently appear in this category independent of the system used to assign points for PBT Characteristics.

- *Chemicals Assigned to "Mid-Range" and "Low" Categories:* The choice of point system appears to impact the placement of two chemicals (trifluralin and toxaphene) that appear at the high and low ends of Table 7. Trifluralin dropped from the "Mid-Range" category to the "Low" category when using the modified PBT point system (relative to January 2001 proposal where all chemicals receive 3 points). Toxaphene rose from the "Low" category to the "Mid-Range" category when using the modified PBT point system. These results are not surprising given that toxaphene had the highest modified point total (9 points) and trifluralin had the lowest (3 points).

- *Relative Ordering of Chemicals in the High, Mid-Range and Low Categories:* The choice of point system did result in some reordering of chemicals or chemical groups within the same category. For example, when using the modified PBT point system, cadmium ranked lower relative to other chemicals/chemical groups in the High Category than when all chemicals received the same PBT Characteristic score. The relative amount of re-ordering increased as greater weights were assigned to the PBT Characteristic Score relative to environmental presence and source releases (See Issue 54 and Table 8.

It does not appear that consideration of cancer risks would significantly alter the modified PBT point totals because (1) many of the chemicals with published slope factors already were assigned 3 points for human health impacts based on consideration of non-cancer health effects and/or (2) ecological toxicity was a more sensitive indicator.

Table 7. Modified PBT Characteristic Scores Used in Ranking Model

Chemical	Regional Half Life (Hours)	Persistence Score	BAF/BCF Value	Basis	Ranking Score	Reference Dose (mg/kg/day)	Ranking Score	Basis	Ecological Toxicity Value (mg/L)	Ranking Score	Basis	Human Health Score	Ecological Score
DDT (total)	36422	3	29512	SRC	3	0.0005	2	IRIS	1E-06	3	FCV	8	9
Toxaphene	39526	3	4E 07	HWIR	3	0.0012	1	NAS	2E-07	3	FCV	7	9
Dioxins and Furans	10986	3	5754	SRC	2	1E-09	3	MRL	0.025	1	AQU	8	6
Heptachlor epoxide	2545	2	14454	SRC	3	1.3E-05	3	IRIS	4E-06	3	FCV	8	8
Chlordane	6682	2	21877	SRC	3	0.00006	3	IRIS	4E-05	3	FCV	8	8
Polychlorinated biphenyls	2578	2	2.9E 07	HWIR	3	0.00007	3	IRIS	1E-05	3	FCV	8	8
Mercury	M	3	6.8E 06	Hg Rpt	3	0.0003	2	IRIS	9E-04	2	FCV	8	8
Hexachlorobenzene	18757	3	18620	SRC	3	0.0008	2	IRIS	0.016	1	AQU	8	7
Lead	M	3	1700	AWQC	1	0.00006	3	Prop.	0.0025	1	FCV	7	5
Hexachlorobutadiene	4506	2	6918	SRC	2	0.0002	3	HEA	0.009	1	AQU	7	5
Lindane	2330	1	32600	HWIR	3	0.0003	2	IRIS	2E-06	3	FCV	6	7
PAHs	10000	2	5000	SRC	2	0.0005	2	IRIS	1E-06	3	FCV	6	7
Cadmium	M	3	4190	AWQC	1	0.0005	2	IRIS	0.001	2	FCV	6	6
Pentachlorobenzene	3656	2	8314	SRC	2	0.0008	2	IRIS	0.005	2	SCV	6	6
Pentabromo diphenyl ether	2724	2	8128	BCFWin	2	0.002	1	IRIS	6E-05	2	ECOSAR	5	6
Endosulfan (a and b)	1027	1	10964	SRC	2	0.006	1	IRIS	9E-06	3	FCV	4	6
Aldrin	2532	1	3715	SRC	1	3E-05	3	IRIS	3E-05	2	SCV	5	4
Dieldrin	1366	1	4466	SRC	1	3E-05	3	IRIS	6E-05	2	FCV	5	4
Methoxychlor	2192	1	8128	SRC	2	0.005	1	IRIS	3E-05	2	FCV	4	5
Pendimethalin	10825	3	1949	BCFWin	1	0.04	1	IRIS	0.016	1	AQU	5	5
1,2,4,5-Tetrachlorobenzene	2393	1	4073	SRC	1	0.0003	2	IRIS	0.001	1	AQU	4	3
Pentachloronitrobenzene	6654	2	1122	SRC	1	0.003	1	IRIS	0.001	1	AQU	4	4
Dicofol (kelthane)	1292	1	12302	SRC	2	0.004	1	HIARC	0.016	1	AQU	4	4
Trifluralin	1635	1	4168	SRC	1	0.0075	1	IRIS	0.001	1	AQU	3	3

See the following page for list of acronyms in this table.

Acronyms for Table 7

SRC = Syracuse Research Corporation ISIS BCF File. Values are reported in EPA (1998b).

HWIR = Hazardous Waste Identification Rule Technical Support Document (EPA, 1995). Values are reported in EPA (1998b).

Hg Rept = Mercury Study Report to Congress (EPA, 1997). Values are reported in EPA (1998b).

AWQC = Ambient Water Quality Criteria Documents (EPA, 1980, 1984, 1987). Values are reported in EPA (1998b).

BCFWin = Bioconcentration Factor Estimation Program. Predicted values are reported in EPA (1998b).

IRIS = Integrated Risk Information System. Values are published online (EPA 2001a).

NAS = National Academy of Sciences (Drinking Water and Health (NAS, 1977).

MRL = Minimal Risk Level published by the Agency for Toxic Substances and Disease Registry (ATSDR, 2001).

HEA = Health Effects Assessment Summary Table published by the Environmental Protection Agency.

Prop = Surrogate reference dose estimated by comparing MTCA Lead Cleanup Standard with cleanup levels for other chemicals and then interpolating the results of other chemicals to predict a reference dose that would result in a lead cleanup standard between 250 and 350 ppm.

HIARC = Hazard Identification Assessment Review Committee recommendations on Reference Doses to be used in implementing the Food Quality Protection Act.

FCV (I,S) = Final Chronic Value developed by EPA. Values reported in EPA (1998b).

AQU = Aquatic Information Retrieval system. Values reported in EPA (1998b).

SCV = Secondary Chronic Value developed by EPA. Values reported in EPA (1998b)

ECOSAR = ECOSAR Class program developed by Syracuse Research Corporation. Values reported in EPA (1998b**).**

54: Does the proposed ranking framework assign an appropriate amount of weight to PBT Characteristics?

Ecology proposed to rank the chemicals on the PBT Working List based on PBT characteristics, environmental presence, and source releases. Under the Ecology proposal, the three factors were assigned equal weights (i.e., each factor could receive a maximum equal to one third of the overall maximum score). Several individuals and organizations expressed the opinion that the PBT characteristics of a chemical were not given a sufficient amount weight. For example:

The algorithm proposed for ranking PBT candidates is arbitrary and appears to give far too much weight to environmental presence/quantity/prevalence and too little weight to the PBT score. A chemical can score at most 33% of the maximum total score on the basis of its PBT score, with the other two thirds entirely determined by indicators of presence in and discharge to the environment. This weighting appears completely arbitrary and would swamp differences in PBT scores with much larger differences in environmental factors that are likely to be much less accurate and reliable; as noted above, the proposed data sets and available methods of determining environmental presence, quantity and prevalence are very limited and may miss or under-rank many PBTs. It is reasonable to attempt to prioritize chemicals based on their ubiquitousness in the environment and resulting exposures of wildlife and humans to these chemicals. However, because these factors are to a large extent unknown and/or unquantified, Ecology should give greater weight to the factors that are known, i.e., persistence, bioaccumulation potential and toxicity. (Rice and Dickey, p. 3)

Ecology's Review and Analysis of Public Comments on Issue 54

Ecology has reviewed the comments on this issue and decided to revise the weighting factors by assigning the following weights to the three factors: PBT Characteristics (50%); Environmental Presence (25%) and Sources/Releases (25%). Ecology agrees with the above comment that there is a certain amount of arbitrariness associated with the choice of weighting factors. The decision to revise the weighting factors is based on several factors:

- *Purpose of the Ranking Exercise:* The purpose of the ranking exercise is to provide a relative ordering or ranking of the chemicals on the PBT Working List. Based on available data, there appears to be greater variability in PBT Characteristics than with the other two factors. Consequently, assigning greater weight to PBT Characteristics will maximize this variability and provide greater spread (less clumping) of chemical rankings.

- *Hazard Equation:* Hazard is generally considered to be a function of toxicity and exposure. Use of a 50% weighting factor for PBT Characteristics is consistent with this relationship if PBT characteristics is considered to be surrogate measure for the toxicity term and Environmental Presence and Source Releases are considered to be surrogate measures for exposure.

- *Uncertainty:* Increasing the weight assigned to PBT Characteristics will minimize the potential skewing of chemical rankings caused by the large gaps in available data on environmental concentrations and source releases.

Ecology compared the chemical rankings obtained using four different weighting factors: (1) PBT characteristics assigned 33 percent[150]; (2) PBT Characteristics assigned 50 percent; (3) PBT Characteristics assigned 67 percent and (4) PBT Characteristics assigned 100 percent (See Table 8). Key observations include:

- *Chemicals Assigned to "High" Category:* In general, the choice of weighting factor does not appear to influence which chemicals or chemical groups are included in the High category. Specifically, the same seven chemicals/chemical groups consistently appear in this category independent of the amount of weight assigned to PBT Characteristics.

- *Chemicals Assigned to "Mid-Range" and "Low" Categories*: The choice of point system appears to impact the placement of two chemicals (trifluralin and toxaphene) that appear at the high and low ends of Table 7. Trifluralin dropped from the "Mid-Range" category to the "Low" category when using the modified PBT point system (relative to January 2001 proposal where all chemicals receive 3 points). Toxaphene rose from the "Low" category to the "Mid-Range" category when using the modified PBT point system. These results are not surprising given that toxaphene had the highest modified point total (9 points) and trifluralin had the lowest (3 points).

- *Relative Ordering of Chemicals in the High, Mid-Range and Low Categories:* The choice of point system did result in some reordering of chemicals or chemical groups within the same category. For example, when using the modified PBT point system, cadmium ranked lower relative to other chemicals/chemical groups in the High Category than when all chemicals received the same PBT Characteristic score. The relative amount of re-ordering increased as greater weights were assigned to the PBT Characteristic Score relative to environmental presence and source releases (See Table 8). However, the significance of such re-ordering is considerably reduced because chemicals have been grouped into three categories

[150] For each weighting alternative, the weight not assigned to PBT Characteristics was evenly divided between Environmental Presence and Source Releases. For example, when PBT Characteristics was assigned a 50% weighting factor, the remaining 50% was divided between Environmental Presence (25%) and Source Releases (25%).

Table 8. Comparison of Relative Rankings with Different Weights for PBT Characteristics

	33% Weight	50% Weight	67% Weight	100% Weight
High	Mercury	Mercury	Mercury	DDT (Total)
	Lead	Lead	Lead	Toxaphene
	PCBs	PCBs	PCBs	Dioxins/Furans
	PAHs	Dioxins/Furans	PAHs	Heptachlor epoxide
	Cadmium	PAHs	Dioxins/Furans	Chlordane
	Dioxins/Furans	Cadmium	Hexachlorobenzene	PCBs
	Hexachlorobenzene	Hexachlorobenzene	Cadmium	Mercury
Mid-range	Chlordane	DDT (total)	DDT (Total)	Lead
	DDT (total)	Chlordane	Chlordane	Hexachlorobutadiene
	Hexachlorobutadiene	Lindane	Heptachlor Epoxide	Lindane
	Aldrin/Dieldrin	Hexachlorobutadiene	Toxaphene	PAHs
	Heptachlor epoxide	Toxaphene	Hexachlorobutadiene	Cadmium
	Toxaphene	Heptachlor epoxide	Lindane	Pentachlorobenzene/ PCNB
	Pentachlorobenzene/ PCNB	Aldrin/Dieldrin	Aldrin/Dieldrin	Pentabromo diphenyl ether
	Lindane	Pentachlorobenzene/ PCNB	Pentachlorobenzene/ PCNB	
Low	Endosulfan	Pentabromo diphenyl ether	Endosulfan	Endosulfan
	Trifluralin	Endosulfan	Pentabromo diphenyl ether	Aldrin/Dieldrin
	Pentabromo diphenyl ether	Trifluralin	Methoxychlor	Methoxychlor
	Methoxychlor	Methoxychlor	Pendimethalin	Pendimethalin
	Dicofol	Pendimethalin	Trifluralin	1,2,4,5 Tetrachlorobenzene
	Pendimethalin	1,2,4,5 Tetrachlorobenzene	Dicofol	Dicofol
	1,2,4,5 Tetrachlorobenzene	Dicofol	1,2,4,5 Tetrachlorobenzene	Trifluralin

55: Does the proposed ranking framework consider a reasonable range of information on the presence of individual chemicals in the Washington environment?

For purposes of ranking chemicals appearing on the PBT list, Ecology proposed to consider five "measures" or "indicators" that a chemical was present in the Washington environment: (1) number of fish consumption advisories for each chemical; (2) relative frequency with which a chemical is found in fish tissue samples collected in Washington waters; (3) relative frequency that a chemical is detected in Washington sediments; (4) relative frequency with which a chemical is reported at National Priority List (NPL) sites in Washington; and (5) relative frequency with which a chemical is shown as responsible for placing waterbodies on the Water Quality 303(d) list (excluding listings based on sediment contamination).

There were several concerns raised by individuals and organizations that provided comments on this aspect of the January 2001 proposal. First, several commentors were concerned that some data would be given greater weight because it would be counted more than once. For example:

The proposed Environmental Presence sector of the scorecard raises numerous questions. For example, it would appear that results may be skewed if a chemical appeared on a 303(d) list for sediment or tissue, thereby being counted twice. Fish tissue data are given twice the weight of other subsectors because they are considered to be closer to the exposure point". But, the relative exposure factor is not considered in the other subsectors or in the Quantity/Prevalence sectors. (Riley, p. 2)

It is difficult to comment on the ranking system separate from the appropriateness of the data sets used to create them; PBT score + environmental presence score+ (the higher of the quantification score and the prevalence score) = total score. The presence score proposed to use three data sources which could easily result in one set of data producing a cumulative score which overstates the ranking of the chemical. For example, sediment results for a chemical would be used once if it supports a fish advisory; again if it is found in the Sediment Quality Information System (SEDQUAL) database and yet again if used to support inclusion on the 303(d) list. …(Nelson, p. 3)

Second, several commentors argued that it was inappropriate to use information on historical releases to set priorities for addressing current releases. For example:

EPA justifies the "Environmental Presence" criteria on the belief that PBT chemicals detected in the environment more frequently than other chemicals should be given higher priority. We are most concerned over the presence of a chemical in the environment when it is somehow linked to loadings from current activities. Reliance on the National Sediment Inventory and the ATSDR HazDat Database are wholly inappropriate as a reflection of current activities. CMA accepts the logic of looking to the Fish Advisory Database as theoretically reflecting not only contemporary activities, but also activities that result in adverse environmental effects… (Perelman, Allen-Kellogg and Shipley, p. 15)

Ecology's Review and Analysis of Public Comments on Issue 55

Ecology has reviewed the comments on this issue and continues to believe that the range of factors identified in the January 2001proposal provide a reasonable framework for characterizing environmental presence because:

- Consistent with PBT Strategy Goals and Policies: The range of factors is consistent with the emphasis on multi-media

- Maximizes Use of Readily Available Information: Ecology believes that priority-setting exercises should not consume an excessive portion of agency resources. Therefore, to the extent possible, the Department has relied upon readily available information collected through existing programs.

- Consistent with the Approach Used by the Environmental Protection Agency: Ecology believes that the range of factors identified in the January 2001 proposal is consistent with EPA's National PBT Strategy and other EPA related directives such as the additional requirements placed on the reporting of PBTs in EPA's Toxics Release Inventory.

With respect to concerns that some of the information may be counted twice, it is important to recognize that the five measures used to characterize the environmental presence of individual chemicals /chemical groups represents a combination of (1) environmental data (e.g., detection frequency for fish tissue and sediment) and (2) environmental data interpreted through the lens of various regulatory programs (e.g., fish tissue advisory, 303(d) list and Superfund listings. There were several reasons Ecology chose this combination of information:

- *Policy choices:* The decision to include two measures of fish tissue concentrations represents a policy choice to assign greater priority to chemicals that are appearing in the foodchain.

- *Estimating Extent and Relative Magnitude:* The decision to include two measures of fish tissue levels was also designed to take into account both the extent of contamination (e.g., the frequency a chemical is found in fish tissue) and the magnitude of contamination (as measured by the number of times fish tissue concentrations were high enough to trigger some type of regulatory response (e.g., fish consumption advisory). The same relationship exists between sediment concentrations (frequency of detection) and various regulatory measures (e.g., Superfund). However, it should be noted that the number of 303(d) listings attributed to individual chemicals does not include waterbodies listed on the basis of sediment contamination.

- *Similarity to Other Ranking Models:* In preparing the proposed ranking framework, Ecology reviewed the methodology developed by EPA to rank PBT chemicals. It includes a similar range of measures for characterizing environmental presence.

With respect to concerns regarding the temporal relationships between environmental concentrations and source releases, Ecology acknowledges that a significant portion of the sediment and Superfund databases may reflect historic releases. The Department believes it is appropriate to use this information when ranking chemicals because the goals of the PBT strategy include (1) preventing ongoing releases and (2) cleaning-up contamination that has resulted from past releases. However, Ecology also intends to consider (on a qualitative basis) the relative contributions from current vs past sources when establishing priorities for chemical action plans and various types of monitoring programs.

56: Does the proposed ranking framework consider a reasonable range of information on sources and releases of individual chemicals?

For purposes of ranking chemicals on the PBT list, Ecology proposed to consider four measures or indicators that a chemical was being released by sources in Washington state: (1) quantity of each chemical being discharged to water and land (as reported in the Toxics Release Inventory); (2) number of sources discharging to water and land (as reported in the Toxics Release

Inventory); (3) the quantity of each chemical released into the air (as reported in the National Toxics Inventory); and (4) number of sources (as reported in the National Toxics Inventory).

There were several concerns raised by individuals and organizations that provided comments on this aspect of the January 2001 proposal. First, many commentors questioned the practical utility of ranking chemicals given the limited data available on the amount of chemicals being released in Washington:

The Quantity sector needs further review and/or explanation. The TRI data is limited in the chemicals involved and in the sources reporting. The NTI data also needs to be reviewed for completeness before its applicability can be assessed. (Riley, p. 2)

Toxics use data is almost non-existent in agency files and databases. While the Pollution Prevention Planning Act of 1990 called for collection of hazardous substance use data from certain industries, Ecology opted by regulation to severely limit collection of that data. Other tools such as Tier I and Tier II reporting under the federal Emergency Planning and Community Right-to-Know Act also generate limited data. …. The Toxics Release Inventory that Ecology proposes to use as one of the data sets catches perhaps 5% of actual toxic releases. Due to thresholds and other major loopholes, a full 95% of the toxic release data is missing in the TRI database. (Rice and Dickey, p. 2)

The proposed method will ignore chemicals for which little or no environmental testing has been done, chemicals for which non-point sources are a significant part of environmental releases, and new chemicals that so far have little use or production in the state. (Johnson, p. 1)

Duplication is not the problem with the quantity datasets. Here, Ecology proposed to use the Toxics Release Inventory (TRI) and the National Toxics Inventory (NTI) databases which were specifically developed to include or exclude certain chemicals not necessarily on the basis of degree of toxicity. For example, dioxins were only recently added to the TRI list. There are similar problems with the sole use of these 2 data sets for the prevalence factor. (Nelson, p. 3)

Several commentors expressed concerns that Ecology's proposed approach would ignore numerous sources of PBT chemicals that (while individually small) might cumulatively result in significant releases of PBT chemicals. For example:

…these data sources do not include non-point source pollution from homes and small businesses. Ecology's proposed approach will ignore such non-point pollution sources. It will ignore all pesticides applied to land, since there is no system in place to report pesticide use in the state. It will ignore discharges of PBT chemicals from publicly-owned wastewater treatment plants. (Rice and Dickey, p. 2)[151]

The Prevalence sector also may be flawed or incomplete. TRI is limited to point sources and may inaccurately skew the data toward a few chemicals emitted by industry. The application of the NTI data also needs clarification. Is each automobile and wood stove a generator? Are

[151] Rice and Dickey provided two examples that they believed illustrated the dangers inherent in the proposed approach. Pesticides and nonyl-phenol.

transportation and wood burning each a single generator? Either way the number may not reflect the relative importance of the category. (Riley, p. 2)

Ecology's Review and Analysis of Public Comments on Issue 56

Ecology has reviewed the comments on this issue and agrees with many of the concerns identified in those comments. However, it is important to recognize that the ranking process represents a screening level analysis designed to provide a rough ordering of chemicals in terms of overall threats.

Currently, Ecology has limited options in terms of addressing these concerns. However, Ecology has taken several steps in response to those limitations. First, Ecology decided to modify the ranking framework to by reducing the amount of weight assigned the source release criterion. Second, Ecology intends to consider other information on sources (e.g., non-point or area sources) and chemical uses when establishing priorities for state action. Chemicals with large information gaps would be prioritized for information collection activities.

Over the long-term, full implementation of the PBT Strategy involves data collection and analysis activities that would serve to address current data gaps.

57: How should Ecology take into account data gaps?

For purposes of ranking chemicals on the PBT list, Ecology proposed to consider four measures or indicators that a chemical was being released by sources in Washington state: (1) quantity of each chemical being discharged to water and land (as reported in the Toxics Release Inventory); (2) number of sources discharging to water and land (as reported in the Toxics Release Inventory); (3) the quantity of each chemical released into the air (as reported in the National Toxics Inventory); and (4) number of sources (as reported in the National Toxics Inventory).

There were several concerns raised by individuals and organizations that provided comments on this aspect of the January 2001 proposal. First, many commentors questioned the practical utility of ranking chemicals given the limited data available on the amount of chemicals being released in Washington:

The Quantity sector needs further review and/or explanation. The TRI data is limited in the chemicals involved and in the sources reporting. The NTI data also needs to be reviewed for completeness before its applicability can be assessed. (Riley, p. 2)

Toxics use data is almost non-existent in agency files and databases. While the Pollution Prevention Planning Act of 1990 called for collection of hazardous substance use data from certain industries, Ecology opted by regulation to severely limit collection of that data. Other tools such as Tier I and Tier II reporting under the federal Emergency Planning and Community Right-to-Know Act also generate limited data. …. The Toxics Release Inventory that Ecology proposes to use as one of the data sets catches perhaps 5% of actual toxic releases. Due to thresholds and other major loopholes, a full 95% of the toxic release data is missing in the TRI database. (Rice and Dickey, p. 2)

The proposed method will ignore chemicals for which little or no environmental testing has been done, chemicals for which non-point sources are a significant part of environmental releases, and new chemicals that so far have little use or production in the state. (Johnson, p. 1)

Duplication is not the problem with the quantity datasets. Here, Ecology proposed to use the Toxics Release Inventory (TRI) and the National Toxics Inventory (NTI) databases which were specifically developed to include or exclude certain chemicals not necessarily on the basis of degree of toxicity. For example, dioxins were only recently added to the TRI list. There are similar problems with the sole use of these 2 data sets for the prevalence factor. (Nelson, p. 3)

Finally, Ecology received comments expressing concerns on how chemicals with no environmental data would be handled:

We are very concerned about Ecology's statement (p. 56) that "PBTs that do not appear on any of the above-mentioned data sources will not receive further consideration under the ranking process outlined here. However, after the ranking has been completed, Ecology may evaluate those chemicals that did not have environmental data associated with them in order to identify reporting or monitoring needs. These chemicals may then be prioritized for further data collection." This may result in highly persistent and toxic chemicals, including those from non-point sources, being de-prioritized when in fact there may be substantial releases. (Rice and Dickey, pp 2-3)

Ecology's Review and Analysis of Public Comments on Issue 57

Ecology has reviewed the comments on this issue. Ecology recognizes that there are sectors and sources for which there is limited or no data for evaluation. Ecology also recognizes that the overall PBT issue is based on emerging information that continues to suggest both the need for continued reductions of PBT releases into the environment and the need for data where data is limited or lacking. As public awareness and understanding about PBTs continues to increase, especially with regards to exposures from non-point airborne releases and in the food chain, Ecology expects more data and information will continue to be collected to help provide a better picture of sectors and sources where data gaps currently exist. Over the long-term, full implementation of the PBT Strategy will need to include data collection and analysis activities that would serve to address current data gaps.

58: Has Ecology proposed a reasonable approach for using the chemical rankings to establish priorities?

Ecology proposed to consider several factors, in addition to the chemical ranking, when establishing priorities for developing future action plans, monitoring programs, etc. There were several concerns raised by individuals and organizations that provided comments on this aspect of the January 2001 proposal. For example:

Programmatic concerns are mentioned briefly in the draft document and are noted to be subject to more review throughout the process. However, they are very important elements that can significantly affect the final results and need careful evaluation before the process is established.

For example, if MTCA and Superfund sites are providing cleanup that is protective of the environment, why should the presence, prevalence, or quantity of a chemical at those sites be included in a priority list? The concepts of "feasibility", "opportunities for reduction", and "cost issues" need to be discussed in advance of establishing a priority process. Opportunities for reduction and feasibility often point to industry regardless of the amount they contribute to the problem. The strategy acknowledges that business has done a great deal to reduce PBT emissions and discharges, and that there are significant public contributions of PBTs that need to be addressed. A priority system that identifies the most significant chemicals, and the most significant contributors of those chemicals, should not be revised because it is more difficult to obtain reductions from area and/or public sources. Societal impacts should be considered and publicized up front, so that resulting action plans are not a surprise. (Riley, p. 2)

Ecology's proposed approach does not provide details on how much weight the chemical ranking and programmatic concerns will have in relation to each other. Ecology's first consideration must be the chemical ranking, as the ranking is the most significant factor in determining which chemicals should be prioritized for reduction and elimination. (Rice and Dickey, p. 3)

Ecology's Review and Analysis of Public Comments on Issue 58

Ecology has reviewed the comments on this issue and acknowledges many of the concerns identified in those comments. Ecology has proposed to develop priorities which would best attempt to define the order for state action (the worst problems that Washington/Ecology can do something about).

The primary purpose behind Ecology's efforts to develop the PBT Working List has been to identify chemicals that the Department believes may require greater attention because of their persistence, bioaccumulation potential and toxicity characteristics. In contrast to earlier proposals, a decision to include a chemical on the PBT Working List will not trigger a specific set of reduction goals or schedules. Indeed, the reduction goals and requirements for chemicals appearing on the PBT Working List will vary from chemical to chemical.[152] Ecology intends to use the PBT Working List in the following three ways:

- *Chemical Action Plans:* Ecology will use the PBT Working List to identify chemicals for which the Department will prepare chemical-specific action plans. Chemical-specific action plans are a central feature of the PBT Strategy and provide a mechanism for identifying and evaluating additional measures to reduce and, where possible, eliminate current sources and uses of individual PBT chemicals. As a first step, Ecology is preparing a chemical action plan to evaluate measures for reducing mercury uses and releases beyond those being achieved through the implementation of current environmental programs.

[152] For some chemicals (e.g., banned pesticides), there may only be limited (if any) actions beyond those being implemented under current environmental programs.

- *Voluntary Measures:* Ecology will use the PBT Working List to identify PBT chemicals that are priorities for voluntary reductions. This is consistent with the primary purpose behind EPA's efforts to identify PBT chemicals as part of the National Waste Minimization Plan.[153]

- *Information Collection and Dissemination:* Ecology will use the PBT Working List to identify PBT chemicals that are a priority for additional monitoring and/or other information collection activities. In most cases, additional information on sources, uses, and environmental concentrations will be needed to support decisions on chemical-specific action plans and voluntary measures. The PBT Working List also provides a mechanism for increasing public awareness on the problems associated with PBT chemicals and steps that individuals and communities might take to reduce PBT chemicals and uses. This is particularly important given that further reductions in sources and uses will often necessitate changes in consumer behavior.

As stated above, Ecology's efforts to develop the PBT Working List have evolved over a three year period from 1998 to 2001. The Department expects the list will evolve further based on additional environmental and source data, new information on the characteristics of individual chemicals becomes available and public dialogue on the initial list. The list's title (PBT Working List) was chosen to emphasize that the list represents a "working" or "living" document that will continue to evolve over time.

Ecology is aware that many sources of PBTs are non-point in nature, and often are releases of very low concentration. However, when all the releases are combined for a PBT, the potential for significant environmental and human health impacts can develop. Ecology believes that determining ways to prevent the use (or release) of a PBT in the first place is the most cost-effective way to minimize this type of threat.

Additionally, Ecology also recognizes that long-term manageability of the PBT Strategy requires consideration of existing legal authorities and programs, availability and opportunities for additional measures, potential effectiveness of such measures and the costs associated with the implementing those measures. Ecology expects continued public and stakeholder involvement and feedback on agency priority making proposals.

[153] Under the Government Performance and Results Act, EPA has committed to reduce PBT chemicals in hazardous waste by 50% by the year 2005 (relative to a 1991 baseline). In 1998, EPA published a draft RCRA PBT List that was designed to help guide voluntary waste minimization efforts. That rule has not been finalized. However, EPA is currently working on a revised list that is scheduled to be published as agency guidance in spring 2002.

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