

**REDUCING THE PURCHASE OF PERSISTENT, BIOACCUMULATIVE TOXINS BY PUBLIC AGENCIES**  
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**Lara L. Sutherland**  
**Alicia A. Culver**  
INFORM, Inc.  
New York, New York

## **ABSTRACT**

Many public agencies, including the federal government, are purchasing environmentally preferable products. While this practice originally started many years ago with buy-recycled campaigns, some purchasers now look at a number of diverse attributes, including toxicity, energy efficiency, user safety, solid waste production, polluting potential of manufacturing method, and other environmental attributes. INFORM has decided to focus its *Purchasing for Pollution Prevention Project* on products containing persistent, bioaccumulative, toxic chemicals (PBTs). Using the US EPA's Draft RCRA Waste Minimization List of Persistent, Bioaccumulative, and Toxic Chemicals, INFORM is researching PBT-containing products and alternatives, providing technical assistance to public agencies, and producing information to assist purchasers in avoiding products with PBTs.

## **INTRODUCTION**

While tens of thousands of potentially toxic chemicals are used by industry today, the US EPA, in response to a growing number of fish advisories across the nation and other critical problems associated with persistent, bioaccumulative toxins (PBTs), has determined that this class of toxic chemicals deserves special attention. Since PBTs are persistent, they linger in the environment, increasing the chance of human exposure. Since they bioaccumulate, they concentrate in the food chain. As a result, they can reach toxic levels over time, even when released in small, legally allowed quantities. Many PBTs threaten to cause long-lasting damage to the environment and public health. According to the US EPA's *About PBTs Factsheet* (2000), "PBTs are associated with a range of adverse human health effects, including effects on the nervous system, reproductive and developmental problems, cancer and genetic impacts." They are especially threatening to children, who typically have less developed immune systems than adults. While a few consumer products containing PBTs (such as leaded house paint) have been restricted or banned in the US, many others continue to be used.

Most consumers (including government purchasing agents) are unaware of the potential hazards of purchasing PBT-containing products, such as paints and printing inks made with heavy metals; toys containing toxic plasticizers; and electronics made with lead solder. Many states and municipalities have adopted laws or

voluntary initiatives to buy recycled or energy-efficient products; however, far fewer have the resources to specify and evaluate products less toxic than conventional goods.

## **BACKGROUND**

### **PBTs in Products**

According to data compiled by Dorfman and Wise (1997), more than 90% of the toxic chemicals reported to be leaving factories in New Jersey are incorporated into consumer and industrial *products*, which can ultimately contaminate the environment through their use and disposal. A recent review of the most recently available New Jersey Materials Accounting Data indicates that this figure has been increasing for a broad range of PBTs. Although the US EPA is working to reduce the amount of PBTs in industrial hazardous waste, no organized plan exists to reduce the incorporation of these chemicals into products. Clearly, a focus on reducing the amount of industrial hazardous waste is inadequate to address the amount of toxins entering the environment. Toxins in products have a potential to expose the manufacturing workers, the users, and anyone coming into contact with the waste stream, which then enters the environment.

### **The PBT List**

The US EPA published its Draft RCRA Waste Minimization List of Persistent, Bioaccumulative, and Toxic Chemicals (Draft PBT List) in November of 1998,

and indicated in the accompanying Fact Sheet (1998) that it intended to use this list to "focus federal, state, industry, and public attention on actions that reduce the generation of these PBT chemicals in RCRA hazardous waste by 50 percent by 2005." This list was established using a methodology established by EPA to prioritize the chemicals regulated by the Resource Conservation and Recovery Act (RCRA) based on the chemicals' persistence, toxicity, and potential to bioaccumulate. The methodology is described in the Research Triangle Institute's "Chemical Screening Report for the RCRA PBT List Docket" (1998). INFORM chose to use this prioritized list of 53 chemicals for four reasons:

- Persistent, bioaccumulative, toxic chemicals have been documented to be a major problem in the environment, causing fish advisories, environmental decline, and human health problems.
- The US EPA is prioritizing the reduction in use of these chemicals and encouraging states to use this list to prioritize their own activities, so this project should coordinate well with state and local government environmental priorities.
- The EPA established this list using a transparent ranking methodology that was adjusted several times based on public comment.
- Most of the chemicals on this list are currently being used by or created by manufacturers in the US.

Draft RCRA PBT List	
Chemical Name	CAS Number
1,1,1-Trichloroethane	71556
1,1-Dichloroethane	75343
1,2,4,5-Tetrachlorobenzene	95943
1,2,4-Trichlorobenzene	120821
1,2-Dichlorobenzene	95501
1,3-Dichlorobenzene	541731
1,4-Dichlorobenzene	106467
2,4,5-Trichlorophenol	95954
2,4,6-Tris(1,1-dimethylethyl) phenol	732263
2-Methylnaphthalene	91576
4-Bromophenyl phenyl ether	101553
Acenaphthene	83329
Acenaphthylene	208968
Alpha-Endosulfan	959988
Anthracene	120127
Antimony	7440360
Arsenic	7440382
Benzo(g,h,i) perylene	191242
Beryllium	7440417
Beta-Endosulfan	33213659
Butylbenzyl phthalate	85687

Cadmium	7440439
Chloroform	67663
Chromium	7440473
Copper	7440508
Cyanide	57125
Di(2-ethylhexyl) phthalate (DEHP)	117817
Dibutyl phthalate	84742
Fluoranthene	206440
Fluorene	86737
Heptachlor	76448
Heptachlor epoxide	1024573
Hexachlorobenzene	118741
Hexachlorobutadiene	87683
Lead	7439921
Lindane (gamma-Hexachlorocyclohexane)	58899
Mercury	7439976
Methoxychlor	72435
Naphthalene	91203
Nickel	7440020
Nitrobenzene	98953
Octachlorosytrene	29082744
Pentachlorobenzene	608935
Pentachloronitrobenzene	82688
Pentachlorophenol	87865
Phenanthrene	85018
Phenol	108952
Polychlorinated dibenzodioxins	NA*
Polychlorinated dibenzofurans	NA*
Polycyclic aromatic hydrocarbons	NA*
Pyrene	129000
Selenium	7782492
Zinc	7440666

\*NA means no CAS number has been assigned to this group of chemicals as a whole.

### STATE PURCHASING

INFORM has chosen to focus on a limited number of states in the initial phase of the project: Massachusetts, Connecticut, New Jersey, and the Great Lakes states (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin). Massachusetts, New Jersey, and Connecticut offer a unique opportunity because these states employ an environmental purchasing coordinator that sits in the purchasing office. Most of these states have made some effort to incorporate environmental attributes into purchasing, and all these states have experienced environmental problems, such as fish advisories, as a result of environmental contamination with PBTs.

Although states are often *willing* to examine the environmental attributes of the products they purchase, they do not always have the *resources* to thoroughly

investigate complex environmental issues such as product toxicity and less toxic alternatives. The goal of the INFORM project is to partner with states and to provide them with the information they need to justify preferentially purchasing products without (or with less) PBTs. Such information includes:

- Which products contain PBTs, and what alternatives are available.
- Whether other public agencies are purchasing the alternatives, and what their experience is.
- Contract language that can be used when procuring alternative products.
- How to verify vendor information indicating that a product contains no PBTs or has a lower concentration of PBTs.
- How to set up take-back contracts for products that have no PBT-free alternative.
- What kind of training will be necessary to use the alternative products.

#### **METHODOLOGY**

INFORM is still developing its methodology for prioritization and research on this project. What follows is the current draft.

#### **Research Priorities**

There are literally thousands of products containing PBTs, and hundreds of different public agencies that buy these products. Because the potential scope of this project is so broad, it is imperative to focus on activities that result in a measurable reduction the number of PBT-containing products bought by participating public agencies. The research for this project can be divided into two categories:

- *General research* into particular chemicals on the list, to find out which products may contain those chemicals.
- *Specific product research* focusing on product areas, investigating which products in a given category may contain any PBT on the list, and what the alternatives are.

**General Research:** Because the list used in this project contains fifty-three chemicals, a method had to be established for choosing which chemicals to analyze first. The following criteria are being used for this purpose:

- *Presence in Waste:* Based on Toxics Release Inventory (TRI) data, is this chemical in the top one-third based on pounds released, and has the number

of pounds released not decreased over the last three years?

- *Presence in Products:* Based on New Jersey Materials Accounting Data, is this chemical being incorporated largely into products, as opposed to being incorporated mostly into waste?
- *Environmental Impact:* Has this chemical's presence in the environment resulted in fish advisories or other widespread public health problems?

INFORM will use these criteria to prioritize chemicals to research, and as the EPA reviews and revises the Draft PBT List, INFORM will adjust its priorities accordingly.

**Specific Product Research:** Product research will be focused in those areas most useful to participating states; therefore, INFORM will first work with participating states to determine which state contracts offer the most opportunity for change, and then research products on those contracts. Promising contracts will be determined using the following criteria, if that seems appropriate for the particular state:

- *Contract Schedule:* Contracts that are coming up for rebid offer an immediate opportunity to use new criteria, preferring non-PBT-containing products. Products on these contracts will be investigated first.
- *Procurement Environment:* Some contracts are easier to work with than others, because the procurement officials working on the contract have time to look at these issues, or because agency using these products has a particular interest in finding environmentally preferable substitutes, or because the nature of the contract is more flexible. Contracts that may be easier to work with will also be prioritized.

Once these promising contracts are found, preliminary research will be done to determine which contracts may include PBT-containing products. These products will then be researched to determine if alternatives are available, and relevant information will be provided to state purchasers.

#### **Alternatives**

As products are researched, a variety of alternatives may be available. Recommended alternatives will be preferred in this order:

1. *PBT-free alternatives.* In most cases, unless it requires the purchase of new equipment or extensive training, a PBT-free alternative is the most preferable.
2. *Alternatives with lower PBT content.* In some cases, a PBT-free alternative is not available or is

otherwise undesirable, but a product with lower PBT content is available.

3. *Take-back or recycling.* If no PBT-free alternative is available, take-back clauses in the purchasing contract, or a separate contract with a recycling company, will be necessary.

## PRODUCTS CONTAINING PBTS

### Specific Chemicals

In the first phase of research, INFORM chose six chemicals on which to focus: cadmium, chromium, di(2-ethylhexyl) phthalate (DEHP), dibutyl phthalate, lead, and mercury. INFORM then created a relational database listing products with the PBTs they contain and linking these products to the public agencies that are most likely to use them. With this data, INFORM created seven fact sheets for various government entities, listing PBT-containing products and their alternatives.

Information on the products that contain PBTs was derived from various documents and databases, including

those developed by the Pacific Northwest Pollution Prevention Research Center, the Agency for Toxic Substances and Disease Registry (U.S. Centers for Disease Control), the National Toxicology Program, independent analytical laboratories, industry-specific publications and trade groups, Toxics Release Inventory data, New Jersey's Materials Accounting Data, and Massachusetts Toxics Use Reduction Act information. Alternative products have been identified by consulting some of the same information sources above, as well as by performing material safety data sheet (MSDS) database searches, general Internet searches, and inquiring of specific organizations such as the Sustainable Hospitals Project (<http://www.uml.edu/LCSP/centers/hospitals>), Green Seal (<http://www.greenseal.org>), the U.S. General Services Administration, Canada's Environmental Choice Program (<http://www.environmentalchoice.com/>), and others that have compiled lists of environmentally preferable products.

### Products Containing PBTs

Schools, Colleges, and Universities		
Product	PBT	Alternative
Computers and Electronics	Mercury, Lead, Cadmium, Copper	Although it is not currently possible to obtain computers that are free of PBTs, schools and universities can specify reduced amounts of these metals or practice product stewardship by requiring the vendor to take back used equipment or setting up a recycling contract.
Diesel-powered School Buses	Polycyclic Aromatic Hydrocarbons, Naphthalene	Natural gas-powered buses could be used.
Laboratory Chemicals	Mercury	Many secondary and even elementary schools have mercury in the science laboratory either for use in experiments or because it was donated by local chemical companies. Mercury and other PBTs do not need to be used in elementary and secondary classrooms. Computer simulations and alternative experiments are available.
Toys	Di(2-ethylhexyl) phthalate (DEHP)	Many soft plastic PVC toys sold in the US and found in kindergartens and preschools contain DEHP. A wide variety of PBT-free toys are available.
Vinyl Upholstery	Di(2-ethylhexyl) phthalate (DEHP)	Many wipe-clean flexible upholstery (vinyl) fabrics contain DEHP. Other upholstery fabrics are available for long-wearing institutional furniture.
Printing Inks	Polycyclic Aromatic Hydrocarbons, Naphthalene	Many water- and vegetable-based inks will not have these contaminants. Printers should also look for ink without heavy metal pigments such as cadmium.
Building Construction Products		
Product	PBT	Alternative
Architectural Paints	Cadmium, Dibutyl Phthalate	Cadmium- and dibutyl phthalate-free paints are available for most architectural uses.
Thermostats	Mercury	Reliable, mercury-free electronic thermostats have been available for some time.
Electrical Switches	Mercury	Mercury-free switches for electrical systems and equipment are available for most situations.

Caulking, Sealants	Dibutyl Phthalate, Lead	Effective caulking and sealers are available without these PBTs.
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Varnishes, Wood Stains	Di(2-ethylhexyl) phthalate (DEHP)	DEHP-free wood varnishes and wood stains are available.
Exit Signs	Copper, Chromium	Buildings should be using light-emitting diode (LED) exit signs because of their energy-efficiency, but should practice product stewardship because of the metals they contain.

<b>Building Management and Maintenance</b>		
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<b>Product</b>	<b>PBT</b>	<b>Alternative</b>
Fluorescent Lights	Mercury	Low-mercury fluorescent lights can be used, and all should be recycled.
Janitorial Disinfectants	Phenol	Heavy-duty disinfectants like phenol are rarely required in institutional settings. Substitutes include non-disinfectant cleaners, bleach made without the mercury-cell process, hydrogen peroxide-based disinfectants, and ammonium quaternary disinfectants (which may provoke sensitivity reactions).
Institutional Cleaners, Bleach	Contaminant Mercury	Although it is hard to validate whether institutional cleaners contain contaminant mercury, the state of Massachusetts has created a database of test results indicating which products are mercury-free ( <a href="http://www.masco.org/mercury">http://www.masco.org/mercury</a> ), and a few manufacturers have tested their products and made this known in product literature. Bleach made without the mercury-cell process is also available.
Air Fresheners	Naphthalene, 1,4-Dichlorobenzene	Air fresheners free of these PBTs are available, as are management strategies that reduce odors in the first place.
Carpet Deodorizers	Naphthalene	Naphthalene-free carpet deodorizers are widely available.
Floor Polishes	Dibutyl Phthalate	Phthalate-free polishes are available.
Liquid Hand Soaps	Di(2-ethylhexyl) phthalate (DEHP)	Many liquid soaps used in institutional restrooms contain DEHP, but phthalate-free products are also available.

<b>Art Supplies</b>		
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<b>Product</b>	<b>PBT</b>	<b>Alternative</b>
Ceramic Glazes	Lead, Cadmium	Lead- and cadmium-free glazes are available in a wide variety of colors to satisfy the needs of secondary school art instruction programs.
Silver Solders for Jewelry	Cadmium	Cadmium-free silver solder is available.
Stained Glass Solders	Lead, Antimony	Solders free of these PBTs are available.
Moth Repellants	Naphthalene, 1,4-Dichlorobenzene	Cedar chips and eucalyptus oil can be used to preserve theater costumes and other stored textiles.
Screen Printing Ink Pigments	Lead, Cadmium, Mercury, Chromium, Arsenic	Pigments without these PBTs are available for art instruction purposes.
Textile Dying Chemicals	Chromium	Chromium-free chemicals are available for many applications.

<b>Departments of Public Works</b>		
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<b>Product</b>	<b>PBT</b>	<b>Alternative</b>
Traffic Marking Paints	Chromium, Lead	Lead- and chromium-free traffic marking paint is now being used in Minnesota.
Diesel-powered Traffic Signs	Polycyclic Aromatic Hydrocarbons, Naphthalene	Solar-powered and hydrogen fuel-cell-powered signs are now being used by many jurisdictions. Although solar cells may contain PBTs, their use does not emit PBTs into the environment if they are properly managed.
Pressure-treated Woods and	Arsenic, Pentachlorophenol,	Recycled plastic lumber is now being used to replace pressure-treated and preserved wood in many applications such as retaining walls, piers, park

Wood Preservatives such as Creosote	Polycyclic Aromatic Hydrocarbons, Naphthalene	benches, etc.
Graffiti Remover	1,1,1-Trichloroethane	Many graffiti removers are available without this chemical, which is being phased out as part of the Montreal Protocol.
Fleet Management		
Product	PBT	Alternative
Degreasers	1,1,1-Trichloroethane	Aqueous and solvent-based cleaners are both available without PBTs.
Motor Oil	Polycyclic Aromatic Hydrocarbons, Naphthalene	Purchasing re-refined motor oil and recycling used oil reduces the amount of PBTs entering the environment.
Petroleum-based Lubricating Oils, Greases and Hydraulic Fluids	Polycyclic Aromatic Hydrocarbons, Naphthalene	Vegetable-based oils, greases and hydraulic fluids are available for many uses in vehicles and equipment with hydraulic lifts and other features.
Switches in Motor Vehicles	Mercury	Some vehicles can be purchased without mercury switches, and vehicles sent to recyclers can be stripped of the mercury switch so it is disposed of properly.
Car Waxes	Di(2-ethylhexyl) phthalate (DEHP)	A wide variety of car waxes without DEHP are available.
Health Care Facilities		
Product	PBT	Alternative
Fever and Laboratory Thermometers	Mercury	Electronic, gallium-tin and other types of thermo-meters are available for most medical and laboratory uses. Care must be taken not to replace mercury thermometers with brands containing mercury batteries or di(2-ethylhexyl) phthalate in the casing.
Blood Pressure Equipment	Mercury	Mercury-free aneroid and electronic blood pressure units (sphygmomanometers) are accurate, available, and widely used.
Batteries	Mercury, Cadmium	Mercury- and cadmium-free batteries are available for some equipment, and the recycling of batteries with PBTs should be institutionalized.
Gastro-intestinal and Feeding Tubes	Mercury	Tubes weighted with tungsten or water are being used in many hospitals today.
IV Bags, Feeding Bags	Di(2-ethylhexyl) phthalate (DEHP)	Alternatives made out of polyolefin (without DEHP) are available for most uses.
Disinfectants	Phenol	Hydrogen peroxide solutions or bleach made without the mercury-cell process can also be used as a disinfectant in some cases. Ammonium quaternary compounds can be used, although sometimes sensitivity and allergy issues arise with these.
Laboratory Chemicals	Mercury	Many laboratory reagents use mercury-based preservatives for colorimetric assays and tissue fixing. Mercury-free alternatives are available for almost all these applications.

### **State Contracts**

In response to a request from the state of Connecticut, information was compiled regarding products on three contracts that were soon going to be rebid: carpeting, major appliances, and pavement marking paint. The following is an example of the type of information INFORM will continue to compile on state contracts coming up for rebid in partner states.

**Carpet and carpet tile:** In carpet, PBTs may show up in three areas: in carpet fibers as part of the dye, in PVC carpet backing, and possibly in the adhesives.

- *Carpet fibers:* According to the US EPA (1997), zinc, nickel or chromium are often integral constituents of dyes. Mercury can also be present as a contaminant in the dye, if mercury was used as a catalyst in its manufacture.
  - It may be very difficult to control for this in bid specifications, because it will be difficult to verify claims and many distributors will not have this information.

- *PVC backing*: Many carpets use PVC as a backing material. It is possible that in some cases the phthalate plasticizer used to make the PVC flexible could be di(2-ethylhexyl) phthalate (DEHP) or dibutyl phthalate (both PBTs). Some PVC also incorporates metals as stabilizers.
  - Distributors may not know what kind of phthalates or metals are used in the backings. If these issues are important, it may be possible to specify non-PVC backing.
- *Adhesives*: An MSDS search indicated that many carpet and carpet tile adhesives and seam sealants are available with no hazardous ingredients listed. Some adhesives do contain hazardous ingredients, but none found contained listed PBTs.
  - Adhesives are probably not a big source of PBTs, but it may be important to use other environmental criteria, such as VOC level or hazardous constituents.

**Pavement Marking Paint**: The most likely source of PBTs in these types of paints appears to be the use of lead and hexavalent chromium for color. Lead- and chromium-free paints are available.

- According to the Minnesota Listed Metals Advisory Council (1999), the Minnesota Department of Transportation has been using lead- and chromium-free pavement marking paint since 1994. The Minnesota Department of Transportation (MN DOT) reported to the author that the MN DOT uses a custom Diamond-Vogel paint, a Polycarb epoxy for high-use areas, and a 3M traffic marking tape, all lead- and chromate-free.

**Major Appliances**: PBTs are present in a variety of appliances. Mercury may be in the pilot lights of gas stoves, fluorescent lights used to illuminate control panels, and mercury lid switches in chest freezers. Appliances may also contain copper, lead, nickel, or chromium in piping, computerized parts, or plating, but it will be more difficult to eliminate these. It may also be desirable to set up a contract for recycling that specifies the removal of PBTs before smelting. Much of the following information comes from the Appliance Recycling Information Center (1998).

- *Gas stoves*: Gas stoves can be equipped with either a mercury pilot light or an electronic ignition system. Electronic ignition systems are now widely available

but require a source of electrical supply near the range, which some older buildings do not have. If this contract is for newer buildings, consider specifying that no mercury pilot lights are allowed.

- *Fluorescent lights*: Some appliances, such as electric ranges and clothes washers, may use fluorescents to illuminate the control panels. Because fluorescent lights are energy efficient, it may not be desirable to prohibit them in purchases. The main concern here would be proper recycling of the light. A fluorescent and appliance recycling program with education for purchasers should be sufficient. The contract could require that vendors include with shipment a notice explaining the necessity for proper recycling of fluorescent bulbs and instructions on how to do so.
- *Lid switches*: Some chest freezers have a mercury switch that senses when the lid is open and turns on the light. Chest freezers without mercury switches are widely available.

## **FUTURE WORK**

### **Current Year**

In this first year of the project, INFORM will continue to work with the states of Massachusetts, Connecticut, New Jersey, and the Great Lakes states to promote the procurement of PBT-free products. INFORM will also continue to research the chemicals on the Draft PBT List and compile information about products containing these chemicals. More fact sheets, detailed information on alternatives, and specification language will be made available to all participating states and all other interested parties. PBT-free purchases will be tracked in participating states and compared to previous purchases.

### **Second Year**

In the second year of the project, INFORM plans to expand its assistance to all states and to write and disseminate case studies from the first year of the project, showcasing state and municipal agencies that have reduced their purchase of PBT-containing products. INFORM will also produce and distribute "*Purchasing Strategies to Prevent Pollution: A Guide to PBT-free Products*," a guide for public purchasers containing all the information gathered in the research phase of the project, including alternative product availability, specification language, and case studies.

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