

# Flame Retardants in our Environment

**Expanded  
2007**

*Latest list of PBDEs  
170 & growing*

*Latest list of PBDE  
Metabolites  
(Hydroxy & Methoxy  
derivatives)  
44 & growing*

*New Methods  
EPA 1614  
EPA 527  
ISO/DIS 22032*

*PBDEs in:  
RoHS list  
(EU 2002/95/EC)  
Endocrine Disruptors list  
(EU 2000/60/EC)*

*New "Other"  
Flame Retardants*

**PBDEs**

**AccuStandard**

# Brominated Flame Retardants

## Background

Brominated Flame Retardants (BFRs) are responsible for saving many lives by minimizing the spread of flames. For the last few decades, BFRs have been used in everything from textiles, furniture, plastic compounds, to circuit boards and building materials (1,2). BFRs are a rather large chemical group that have in it Tetrabromobisphenol A (TBBPA), Polybrominated Diphenyl Ethers (PBDEs), Polybrominated Biphenyls (PBBs), and hexabromocyclododecane (HBCD or HBCDD) (2). In the most recent years, there has been much discussion about products having both a positive and a negative effect on consumers and industry. Both consumers and industry have changed their opinion about the flame retardant Polybrominated diphenyl ethers. In the last few years, the monitoring has resulted in a growing concern about the toxicological effects of this chemical family.

There are 209 congeners of the PBDEs, but what is actually used as a flame-retardant is usually a technical mixture of several congeners plus other ingredients. There are several similarities with PCBs, as there are also 209 PCB congeners, and the actual material used were technical mixtures composed of several congeners plus other ingredients. Of the 209 PBDE congeners, there are only several, which make up the majority of the production, and these are PBDE 28, 47, 99, 100, 153, 154, 183 and 209 (3,4). While this simplifies the monitoring, it has now been found that some of the congeners lose bromine.

“Researchers and environmental groups are concerned about emerging pollution problems, pointing both to the growing body of evidence that PBDEs are ubiquitous in the environment and to evidence suggesting that low-level exposures may produce detrimental health effects in humans and animals” (1).

PBDEs have been largely used as flame-retardants in furniture, plastics, and in electronics. They have been found in such basic products as upholstered furniture and padded mattresses. If the cushion in these items is comprised of polyurethane foam, chances are, up to 30% of the foam’s weight is actually composed of PBDEs. In the upholstery industry, ranging from household and office furniture to airline and automobile seats, the commercial mix, penta, including PBDE 47, 99, 100, 153, 154 is the primary mixture used as a flame retardant (5,15). PBDEs do not bind chemically to plastics and foam, and are therefore easily leached out (7). When items containing PBDEs break down or are incinerated for disposal, these PBDEs are released into the air as dust and then wind up on the ground and in waterways. Once they wind up in the waterways, the fish become contaminated (5,6).

## Toxicological Links

PBDE congeners are attracting the same type of attention, as did polychlorinated biphenyls (PCBs) and dioxins. “Based on available toxicity data and structural and mechanistic similarities with PCBs, the toxic endpoints likely to be the most sensitive for the PBDEs are thyroid hormone disruption, neurobehavioral toxicity and, for some congener, possibly cancer.” It has been found that the PBDEs will concentrate in adipose tissue (7).. There is mounting evidence that, since the outlaw of PCBs and DDT in the early 1970’s, levels of PCBs and DDT are decreasing. However, while they are decreasing, the levels of PBDEs are actually rising (1). The reason for this concern is that like PCBs, PBDEs resist degradation. Because they resist degradation, they are going to remain in waterways and organisms residing in the waterways, and mammals consuming the water and the organisms in the waterways.

- This concentration in adipose tissue has been found to affect both endocrine and hepatic functions (2,12) as well as reproductive development (7,9).
- A study in England using neonatal mice suggests that there is additional evidence to believe that brain development may be affected at low doses resulting in long-term behavioral effects of the mice well into adulthood (3,4,7). These findings, although preliminary, have prompted studies and evaluations in humans.
- Studies conducted in Vancouver, BC demonstrated that the levels of PBDEs in women’s breast milk have doubled every 2.5 years over the last decade (5).
- A study evaluating California women by the California EPA is consistent with the study conducted in Vancouver. The results showed elevated level of PBDEs, varying from 3-10 times higher than what was found in European women (8).
- A 1998 study clearly showed that concentrations in mothers’ breast milk increased exponentially from 1972 - 1997, doubling every 5 years (3).
- Another study showed that levels are doubling every 4 years in North America exclusively, and some women’s bodily concentrations are approaching levels that harmed newborn animals’ developing brains in laboratory studies (9). This is a growing concern that babies in utero are exposed to these ever growing levels of the PBDEs, and this alone appears to result in developmental issues. Babies are then exposed to additional doses when they consume mother’s breast milk.
- During the 2003 Dioxin Conference in Boston, Massachusetts, it was reported that, "even smaller doses fed to newborn lab animals alter their reproductive development as well, apparently by interfering with estrogen hormones" (9).
- Studies by Berlin’s Freie Universitat show that the flame-retardants are toxic to the females rodents’ ovaries and reduce the males reproductive performance (7)."

## The Move Away From PBDEs Has Begun

The rising concern has prompted many legislative bodies around the world to begin discussion of banning the manufacture and use of certain PBDEs. Companies that use the PBDEs have begun to switch to less controversial flame-retardants.

- Findings have prompted many European companies to voluntarily phase out the production of PBDEs since the early 1990’s, and the EU has banned the use of several PBDEs starting in 2003 (6).
- Sweden and Denmark, specifically have banned some PBDEs (1).
- Dr. Bergman, as reported during the 2003 Dioxin Conference in Boston, Massachusetts, reported that since the voluntary phase out of the pentas and octas within the EU, there has been a decline in the levels of PBDEs present in breast milk (10,13).
- The State of California agreed to ban the use of several PBDEs by 2008, specifically the pentas and octas (5).
- The California law, known as AB 302, states that any product containing more than 1/10 of 1% by mass of either of the pentas or octas are prohibited from manufacture, sale or distribution in California after 2007 (8,11).

# Brominated Flame Retardants

- Likewise, one of the two manufacturers of bulk PBDEs in the U.S., Great Lakes Chemical Co., announced in October 2003, that they will voluntarily phase out production of the penta and octa PBDEs (12,13).
- The US EPA is promulgating a new method for the monitoring of PBDEs, Method 1614. This method has been developed for the “determination of brominated diphenyl ethers in water, soil, sediment, biosolids, tissue and other sample matrices by high resolution gas chromatography combined with high resolution mass spectrometry (HRGC/HRMS)” (4).

## The Deca

Of growing concern among the scientific community in addition to the pentas and octas is the deca PBDE congeners. The deca PBDE is another form of PBDE and is commonly used in housing for electronics (8,15) such as televisions and computers (9) and in textiles, and insulators (15).

Derek Muir of the Canadian National Water Research Institute has found the deca compound in the sediments of remote lakes in the Canadian Arctic. The deca is now beginning to be considered more of a problem than originally believed because although it is not in itself a mobile chemical, it is obviously migrating. It has appeared in 6 of 23 women tested in a Dallas, Texas clinic and has been appearing in birds of prey (5). This is of even greater importance because it is demonstrating that it does not always debrominate to penta and octa as originally believed. The question that is being asked is why would the pentas and octas be banned but not the deca, especially if it has the potential to form the PBDE congeners with lower bromine content which are thought to be more toxic?

## The Future

The next several years will undoubtedly see an increased awareness and understanding of the unexpected negative effects of this product that saves lives every day. Expected changes can be grouped into three areas: awareness, further understanding of the effects, finding replacements and transitioning to replacements with new flame retardants.

Awareness - Societies across the globe need to be aware of which products contain PBDEs as their flame retardants. To accomplish this, labeling must be agreed upon, implemented and standardized globally. Such an effort is currently being undertaken for all chemicals in the EU under the proposed REACH program. This labeling allows individuals to decide for themselves if they want to use such products.

Understanding the Effects - While several toxicological links have been demonstrated, much more will be done to better understand the compounds. Studies are ongoing throughout the world to not only determine the manner in which they enter the environment and the manner they enter the human lifecycle, but to find replacements that do not possess potential for both human and environmental hazards.

Finding Replacements - Another step is to determine suitable replacements for the PBDEs as flame retardants. One alternative that has been considered as a suitable candidate, HBCD, has been found to be not so suitable because it is potentially more prone to bioaccumulation than PBDEs and potentially just as toxic to humans (5).

## AccuStandard

AccuStandard is the only company in the world to synthesize all 209 PCB congeners, and is well on the way to accomplishing similar success for the PBDEs. Currently, AccuStandard has synthesized over 170 PBDE congeners.

<b>Individual Polybromodiphenyl Ethers</b>	<b>2-4</b>
<b>Polybromodiphenyl Ethers Mixtures</b>	<b>4</b>
<b>RoHS &amp; Endocrine Disruptors</b>	<b>4</b>
<b>State PBDE Mixtures, EPA Method 527 &amp; ISO/DIS 22032</b>	<b>5</b>

<b>EPA Method 1614</b>	<b>6</b>
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<b>Other Flame Retardants</b>	<b>8</b>
<b>Bromobiphenyls</b>	<b>9</b>

## References:

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# Individual Polybromodiphenyl Ethers

AccuStandard has synthesized and cataloged more than 170 pure PBDE congeners for use as standards for toxicology research and in the identification of unknown substances in environmental samples.

COMPOUND	CAS NO.	QTY./CONC.	MATRIX	CAT. NO.	UNIT
2-Bromodiphenyl ether		50 µg/mL	Isooctane	BDE-001S	1 mL
3-Bromodiphenyl ether		50 µg/mL	Isooctane	BDE-002S	1 mL
4-Bromodiphenyl ether	101-55-3	50 µg/mL	Isooctane	BDE-003S	1 mL
2,2'-Dibromodiphenyl ether		50 µg/mL	Isooctane	BDE-004S	1 mL
2,3'-Dibromodiphenyl ether		50 µg/mL	Isooctane	BDE-005S	1 mL
2,3'-Dibromodiphenyl ether		50 µg/mL	Isooctane	BDE-006S	1 mL
2,4'-Dibromodiphenyl ether		50 µg/mL	Isooctane	BDE-007S	1 mL
2,4'-Dibromodiphenyl ether		50 µg/mL	Isooctane	BDE-008S	1 mL
2,5'-Dibromodiphenyl ether		50 µg/mL	Isooctane	BDE-009S	1 mL
2,6'-Dibromodiphenyl ether		50 µg/mL	Isooctane	BDE-010S	1 mL
3,3'-Dibromodiphenyl ether		50 µg/mL	Isooctane	BDE-011S	1 mL
3,4'-Dibromodiphenyl ether		50 µg/mL	Isooctane	BDE-012S	1 mL
3,4'-Dibromodiphenyl ether		50 µg/mL	Isooctane	BDE-013S	1 mL
3,5'-Dibromodiphenyl ether		50 µg/mL	Isooctane	BDE-014S	1 mL
4,4'-Dibromodiphenyl ether	2050-47-7	50 µg/mL	Isooctane	BDE-015S	1 mL
2,2',3'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-016S	1 mL
2,2',4'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-017S	1 mL
2,2',5'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-018S	1 mL
2,2',6'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-019S	1 mL
2,3,3'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-020S	1 mL
2,3,4'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-021S	1 mL
2,3,4'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-022S	1 mL
2,3,5'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-023S	1 mL
2,3',4'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-025S	1 mL
2,3',5'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-026S	1 mL
2,3',6'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-027S	1 mL
2,4,4'-Tribromodiphenyl ether	41318-75-6	50 µg/mL	Isooctane	BDE-028S	1 mL
2,4,5'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-029S	1 mL
2,4,6'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-030S	1 mL
2,4',5'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-031S	1 mL
2,4',6'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-032S	1 mL
2',3,4'-Tribromodiphenyl ether	147217-78-5	50 µg/mL	Isooctane	BDE-033S	1 mL
2',3,5'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-034S	1 mL
3,3',4'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-035S	1 mL
3,3',5'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-036S	1 mL
3,4,4'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-037S	1 mL
3,4,5'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-038S	1 mL
3,4',5'-Tribromodiphenyl ether		50 µg/mL	Isooctane	BDE-039S	1 mL
2,2',3,3'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-040S	1 mL
2,2',3,4'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-041S	1 mL
2,2',3,4'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-042S	1 mL
2,2',3,5'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-043S	1 mL
2,2',3,5'-Tetrabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-044S	1 mL
2,2',3,6'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-046S	1 mL
2,2',4,4'-Tetrabromodiphenyl ether	5436-43-1	50 µg/mL	Isooctane	BDE-047S	1 mL
2,2',4,5'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-048S	1 mL
2,2',4,5'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-049S	1 mL
2,2',4,6'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-050S	1 mL
2,2',4,6'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-051S	1 mL
2,2',5,5'-Tetrabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-052S	1 mL
2,2',5,6'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-053S	1 mL
2,2',6,6'-Tetrabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-054S	1 mL
2,3,3',4'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-055S	1 mL
2,3,3',4'-Tetrabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-056S	1 mL
2,3,3',5'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-057S	1 mL
2,3,3',5'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-058S	1 mL
2,3,4,4'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-060S	1 mL
2,3,4,5'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-061S	1 mL
2,3,4,6'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-062S	1 mL
2,3,4',5'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-063S	1 mL
2,3',4,4'-Tetrabromodiphenyl ether	189084-61-5	50 µg/mL	Isooctane	BDE-066S	1 mL
2,3',4,5'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-067S	1 mL
2,3',4,5'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-068S	1 mL
2,3',4,6'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-069S	1 mL
2,3',4',5'-Tetrabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-070S	1 mL
2,3',4',6'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-071S	1 mL
2,3',5,5'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-072S	1 mL
2,3',5',6'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-073S	1 mL
2,4,4',5'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-074S	1 mL
2,4,4',6'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-075S	1 mL
2',3,4,5'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-076S	1 mL
3,3',4,4'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-077S	1 mL
3,3',4,5'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-078S	1 mL

Additional congeners are added continuously, for an update, check our website.



# Individual Polybromodiphenyl Ethers

COMPOUND	CAS NO.	QTY./CONC.	MATRIX	CAT. NO.	UNIT
3,3',4,5'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-079S	1 mL
3,3',5,5'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-080S	1 mL
3,4,4',5'-Tetrabromodiphenyl ether		50 µg/mL	Isooctane	BDE-081S	1 mL
2,2',3,3',4'-Pentabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-082S	1 mL
2,2',3,3',5'-Pentabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-083S	1 mL
2,2',3,4,4'-Pentabromodiphenyl ether	182346-21-0	50 µg/mL	Isooctane	BDE-085S	1 mL
2,2',3,4,5'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-086S	1 mL
2,2',3,4,5'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-087S	1 mL
2,2',3,4,6'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-088S	1 mL
2,2',3,4,6'-Pentabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-089S	1 mL
2,2',3,4',5'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-090S	1 mL
2,2',3,5,5'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-092S	1 mL
2,2',3,5,6'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-094S	1 mL
2,2',3',4,5'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-097S	1 mL
2,2',3',4,6'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-098S	1 mL
2,2',4,4',5'-Pentabromodiphenyl ether	60348-60-9	50 µg/mL	Isooctane	BDE-099S	1 mL
2,2',4,4',6'-Pentabromodiphenyl ether	189084-64-8	50 µg/mL	Isooctane	BDE-100S	1 mL
2,2',4,5,5'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-101S	1 mL
2,2',4,5,6'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-102S	1 mL
2,2',4,5',6'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-103S	1 mL
2,2',4,6,6'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-104S	1 mL
2,3,3',4,4'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-105S	1 mL
2,3,3',4,5'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-106S	1 mL
2,3,3',4',5'-Pentabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-107S	1 mL
2,3,3',4,5'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-108S	1 mL
2,3,3',4,6'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-109S	1 mL
2,3,3',5,5'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-111S	1 mL
2,3,4,4',5'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-114S	1 mL
2,3,4,4',6'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-115S	1 mL
2,3,4,5,6'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-116S	1 mL
2,3',4,4',5'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-118S	1 mL
2,3',4,4',6'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-119S	1 mL
2,3',4,5,5'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-120S	1 mL
2,3',4,5',6'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-121S	1 mL
2,3,3',4,5'-Pentabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-122S	1 mL
2',3,4,4',5'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-123S	1 mL
2',3,4,5,5'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-124S	1 mL
2',3,4,5,6'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-125S	1 mL
3,3',4,4',5'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-126S	1 mL
3,3',4,5,5'-Pentabromodiphenyl ether		50 µg/mL	Isooctane	BDE-127S	1 mL
2,2',3,3',4,4'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-128S	1 mL
2,2',3,3',4,5'-Hexabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-129S	1 mL
2,2',3,3',4,5'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-130S	1 mL
2,2',3,3',4,6'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-131S	1 mL
2,2',3,3',5,5'-Hexabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-133S	1 mL
2,2',3,3',6,6'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-136S	1 mL
2,2',3,4,4',5'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-137S	1 mL
2,2',3,4,4',5'-Hexabromodiphenyl ether	182677-30-1	50 µg/mL	Isooctane	BDE-138S	1 mL
2,2',3,4,4',6'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-139S	1 mL
2,2',3,4,4',6'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-140S	1 mL
2,2',3,4,5,5'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-141S	1 mL
2,2',3,4,5,6'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-142S	1 mL
2,2',3,4,5,6'-Hexabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-143S	1 mL
2,2',3,4,5',6'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-144S	1 mL
2,2',3,4,6,6'-Hexabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-145S	1 mL
2,2',3,4',5,5'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-146S	1 mL
2,2',3,4',5,6'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-148S	1 mL
2,2',3,4',6,6'-Hexabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-150S	1 mL
2,2',4,4',5,5'-Hexabromodiphenyl ether	68631-49-2	50 µg/mL	Isooctane	BDE-153S	1 mL
2,2',4,4',5,6'-Hexabromodiphenyl ether	207122-15-4	50 µg/mL	Isooctane	BDE-154S	1 mL
2,2',4,4',6,6'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-155S	1 mL
2,3,3',4,4',5'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-156S	1 mL
2,3,3',4,4',5'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-157S	1 mL
2,3,3',4,4',6'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-158S	1 mL
2,3,3',4,5,5'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-159S	1 mL
2,3,3',4,5,6'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-160S	1 mL
2,3,3',4,5',6'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-161S	1 mL
2,3,3',4',5,5'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-162S	1 mL
2,3,4,4',5,6'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-166S	1 mL
2,3',4,4',5,5'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-167S	1 mL
2,3',4,4',5',6'-Hexabromodiphenyl ether		50 µg/mL	Isooctane	BDE-168S	1 mL
3,3',4,4',5,5'-Hexabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-169S	1 mL

We also offers custom synthesis of congeners not currently found in the catalog or website.

Continued on next page

# Individual PBDEs and Mixtures

COMPOUND	CAS NO.	QTY/CONC.	MATRIX	CAT. NO.	UNIT
2,2',3,3',4,5,5'-Heptabromodiphenyl ether		50 µg/mL	Isooctane	BDE-172S	1 mL
2,2',3,3',4,5,6-Heptabromodiphenyl ether		50 µg/mL	Isooctane	BDE-173S	1 mL
2,2',3,3',4,5',6-Heptabromodiphenyl ether		50 µg/mL	Isooctane	BDE-175S	1 mL
2,2',3,3',4,6,6'-Heptabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-176S	1 mL
2,2',3,4,4',5,5'-Heptabromodiphenyl ether		50 µg/mL	Isooctane	BDE-180S	1 mL
2,2',3,4,4',5,6-Heptabromodiphenyl ether		50 µg/mL	Isooctane	BDE-181S	1 mL
2,2',3,4,4',5,6'-Heptabromodiphenyl ether		50 µg/mL	Isooctane	BDE-182S	1 mL
2,2',3,4,4',5',6-Heptabromodiphenyl ether	207122-16-5	50 µg/mL	Isooctane	BDE-183S	1 mL
2,2',3,4,4',6,6'-Heptabromodiphenyl ether		50 µg/mL	Isooctane	BDE-184S	1 mL
2,2',3,4,5,5',6-Heptabromodiphenyl ether		50 µg/mL	Isooctane	BDE-185S	1 mL
2,2',3,4,5,6,6'-Heptabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-186S	1 mL
2,3,3',4,4',5,5'-Heptabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-189S	1 mL
2,3,3',4,4',5,6-Heptabromodiphenyl ether		50 µg/mL	Isooctane	BDE-190S	1 mL
2,3,3',4,4',5',6-Heptabromodiphenyl ether		50 µg/mL	Isooctane	BDE-191S	1 mL
2,3,3',4,5,5',6-Heptabromodiphenyl ether		50 µg/mL	Isooctane	BDE-192S	1 mL
2,2',3,3',4,4',5,6'-Octabromodiphenyl ether		50 µg/mL	Isooctane	BDE-196S	1 mL
2,2',3,3',4,4',6,6'-Octabromodiphenyl ether		50 µg/mL	Isooctane	BDE-197S	1 mL
2,2',3,3',4,5,5',6-Octabromodiphenyl ether		50 µg/mL	Isooctane	BDE-198S	1 mL
2,2',3,3',5,5',6,6'-Octabromodiphenyl ether <b>NEW</b>		50 µg/mL	Isooctane	BDE-202S	1 mL
2,2',3,4,4',5,5',6-Octabromodiphenyl ether		50 µg/mL	Isooctane	BDE-203S	1 mL
2,2',3,4,4',5,6,6'-Octabromodiphenyl ether		50 µg/mL	Isooctane	BDE-204S	1 mL
2,3,3',4,4',5,5',6-Octabromodiphenyl ether		50 µg/mL	Isooctane	BDE-205S	1 mL
2,2',3,3',4,4',5,5',6-Nonabromodiphenyl ether		50 µg/mL	Isooctane	BDE-206S	1 mL
2,2',3,3',4,4',5,6,6'-Nonabromodiphenyl ether		50 µg/mL	Isooctane	BDE-207S-R1	1 mL
		10 µg/mL	Nonane	BDE-207S-0.2X	1 mL
2,2',3,3',4,5,5',6,6'-Nonabromodiphenyl ether		50 µg/mL	Isooctane	BDE-208S	1 mL
Decabromodiphenyl ether	1163-19-5	50 µg/mL	Isooctane	BDE-209S	1 mL

## PBDE Congeners common to Technical Mixtures (Bromkal™)

<b>BDE-BROMKAL</b>	<b>1 x 1 mL</b>
10 µg/mL each in Isooctane	6 comps.
(BZ#)	
2,4,4'-Tribromodiphenyl ether (#28)	
2,2',4,4'-Tetrabromodiphenyl ether (#47)	
2,2',4,4',5-Pentabromodiphenyl ether (#99)	
2,2',4,4',6-Pentabromodiphenyl ether (#100)	
2,2',4,4',5,5'-Hexabromodiphenyl ether (#153)	
2,2',4,4',5,6'-Hexabromodiphenyl ether (#154)	

## PBDE Technical Grade

50 µg/mL in Isooctane		
Bromkal DE-70-5 (Pentas)	BDE-705	1 mL
Bromkal DE-71 (Pentas)	BDE-710	1 mL
Bromkal DE-73-6 (Hexas)	BDE-736	1 mL
Bromkal DE-79-8 (Octas)	BDE-798	1 mL
FR-300BA (Deca)	FRS-009N	10 mg
	FRS-009S*	1 mL

\* 100 µg/mL in Toluene

## Hexabromocyclododecane Isomers

100 µg/mL in Toluene		
α-Hexabromocyclododecane	HXBCD-01	1 mL
β-Hexabromocyclododecane	HXBCD-02	1 mL
γ-Hexabromocyclododecane	HXBCD-03	1 mL

## Common PBDEs in the Environment

<b>BDE-USE</b>	<b>1 x 1 mL</b>
10 µg/mL each in Isooctane	5 comps.
(BZ#)	
2,2',4,4'-Tetrabromodiphenyl ether (#28)	
2,2',4,4',5-Pentabromodiphenyl ether (#99)	
2,2',4,4',6-Pentabromodiphenyl ether (#100)	
2,2',4,4',5,5'-Hexabromodiphenyl ether (#153)	
2,2',4,4',5,6'-Hexabromodiphenyl ether (#154)	

AccuStandard is continuously adding new PBDEs and PBDE Mixtures, check our website for latest products.

## EU Directives for Endocrine Disruptors and RoHS/WEEE Regulations

**Endocrine Disruptors** to be Monitored by the Directive 2000/60/EC, Annex X & Regulation (EEC) No. 793/93. 4 of the Endocrine Disruptors listed in EU Directive 2000/60/EC are PBDEs.

**For a complete list of AccuStandard products for this regulation, see [http://www.accustandard.com/asi/np\\_endocrine\\_disruptors.php3](http://www.accustandard.com/asi/np_endocrine_disruptors.php3)**

**RoHS/WEEE Regulations (2002/95/EC)** Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2004. 2002/95/EC monitors 28 elements 8 are PBDEs.

**For a complete list of AccuStandard products for this regulation, see [http://www.accustandard.com/asi/np\\_rohs\\_weene.php3](http://www.accustandard.com/asi/np_rohs_weene.php3)**

For a complete listing of EU Directives products visit this website link. [http://www.accustandard.com/asi/eu\\_regs.php3](http://www.accustandard.com/asi/eu_regs.php3)

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# State PBDE Mixtures, EPA Method 527 & ISO/DIS 22032

## BDE-LMS

10 µg/mL each in Isooctane

(BZ#)

- 2,4,4'-Tribromodiphenyl ether (#28)
- 2,2',4,4'-Tetrabromodiphenyl ether (#47)
- 2,3',4,4'-Tetrabromodiphenyl ether (#66)
- 2,2',3,4,4'-Pentabromodiphenyl ether (#85)
- 2,2',4,4',5-Pentabromodiphenyl ether (#99)
- 2,2',4,4',6-Pentabromodiphenyl ether (#100)
- 2,2',3,4,4',5'-Hexabromodiphenyl ether (#138)
- 2,2',4,4',5,5'-Hexabromodiphenyl ether (#153)
- 2,2',4,4',5,6'-Hexabromodiphenyl ether (#154)

1 x 1 mL

9 comps.



## DE-71 (Pentas) Great Lakes

### BDE-710-GL

50 µg/mL each in Isooctane

Bromkal DE-71

1 x 1 mL

## DE-79 (Octas) Great Lakes

### BDE-798-GL

50 µg/mL each in Isooctane

DE-79 (Great Lakes)



## PBDEs in Columbia River

### BDE-CR

10 µg/mL each in Isooctane

(BZ#)

- 4,4'-Dibromodiphenyl ether (#15)
- 2,4,4'-Tribromodiphenyl ether (#28)
- 2',3,4-Tribromodiphenyl ether (#33)
- 2,2',4,4'-Tetrabromodiphenyl ether (#47)
- 2,2',4,5'-Tetrabromodiphenyl ether (#49)
- 2,3',4,4'-Tetrabromodiphenyl ether (#66)
- 2,4,4',6-Tetrabromodiphenyl ether (#75)
- 2,2',4,4',5-Pentabromodiphenyl ether (#99)
- 2,2',4,4',6-Pentabromodiphenyl ether (#100)
- 2,2',4,4',5,5'-Hexabromodiphenyl ether (#153)
- 2,2',4,4',5,6'-Hexabromodiphenyl ether (#154)
- 2,2',4,4',6,6'-Hexabromodiphenyl ether (#155)

1 x 1 mL

12 comps.

## California Method 750-M Standard

### BDE-CALEWS

10 µg/mL each in Isooctane

(BZ#)

- 2,2',4-Tribromodiphenyl ether (#17)
- 2,4,4'-Tribromodiphenyl ether (#28)
- 2,2',4,4'-Tetrabromodiphenyl ether (#47)
- 2,3',4,4'-Tetrabromodiphenyl ether (#66)
- 2,3',4',6-Tetrabromodiphenyl ether (#71)
- 2,2',4,4',5-Pentabromodiphenyl ether (#99)
- 2,2',4,4',6-Pentabromodiphenyl ether (#100)
- 2,2',3,4,4',5'-Hexabromodiphenyl ether (#138)
- 2,2',4,4',5,5'-Hexabromodiphenyl ether (#153)
- 2,2',4,4',5,6'-Hexabromodiphenyl ether (#154)
- 2,2',3,4,4',5',6-Heptabromodiphenyl ether (#183)
- 2,2',3,3',4,4',5,5',6,6'-Decabromodiphenyl ether (#209)
- 2,2',6,6'-Tetrabromobisphenol A

1 x 1 mL

13 comps.

## PBDE Congeners common to California Environment

### BDE-CAE-1

10 µg/mL each in Isooctane

(BZ#)

- 2,4,4'-Tribromodiphenyl ether (#28)
- 2',3,4-Tribromodiphenyl ether (#33)
- 2,2',4,4'-Tetrabromodiphenyl ether (#47)
- 2,2',4,4',5-Pentabromodiphenyl ether (#99)
- 2,2',4,4',6-Pentabromodiphenyl ether (#100)
- 2,2',4,4',5,5'-Hexabromodiphenyl ether (#153)
- 2,2',4,4',5,6'-Hexabromodiphenyl ether (#154)

1 x 1 mL

7 comps.

## EPA Method 527 PBDE Standard

### M-527-BDE

50 µg/mL each in

Isooctane:Ethyl Acetate (8:2)

(BZ#)

- 2,2',4,4'-Tetrabromodiphenyl ether (#47)
- 2,2',4,4',6-Pentabromodiphenyl ether (#100)
- 2,2',4,4',5-Pentabromodiphenyl ether (#99)
- 2,2',4,4',5,5'-Hexabromodiphenyl ether (#153)
- 2,2',4,4',5,5'-Hexabromobiphenyl

1 x 1 mL

5 comps.



See our catalog or website for a complete listing of Method 527, see [http://www.accustandard.com/asi/np\\_500series.php3](http://www.accustandard.com/asi/np_500series.php3)

## INTERNATIONAL STANDARD

### ISO/DIS 22032 Calibration Curve Set

#### ISO/DIS-22032-SET

At stated conc. (ng/mL) in Isooctane

(BZ#)

#### ISO/DIS-22032

	01	02	03	04	05	06	07
2,2',4,4'-Tetrabromodiphenyl ether (#47)	5	12.5	25	50	100	150	250
2,2',4,4',5-Pentabromodiphenyl ether (#99)	5	12.5	25	50	100	150	250
2,2',4,4',6-Pentabromodiphenyl ether (#100)	5	12.5	25	50	100	150	250
2,2',4,4',5,5'-Hexabromodiphenyl ether (#153)	5	12.5	25	50	100	150	250
2,2',4,4',5,6'-Hexabromodiphenyl ether (#154)	5	12.5	25	50	100	150	250
2,2',3,4,4',5',6-Heptabromodiphenyl ether (#183)	5	12.5	25	50	100	150	250
2,2',3,3',4,4',5,5',6-Octabromodiphenyl ether (#205)	5	12.5	25	50	100	150	250
2,2',3,3',4,4',5,5',6,6'-Decabromodiphenyl ether (#209)	25	50	100	200	500	700	1000

7 x 1 mL

8 comps. each

## ISO/DIS 22032 Internal Standard for BDE-47, 99 & 100

### ISO22032-IS-1-5ML

1 x 5 mL

### ISO22032-IS-1-10ML

1 x 10 mL

100 ng/mL each in Isooctane

3,3',4,4'-Tetrabromodiphenyl ether (#47)

## ISO/DIS 22032 Internal Standard for BDE-153, 154 & 183

### ISO22032-IS-2-5ML

1 x 5 mL

### ISO22032-IS-2-10ML

1 x 10 mL

100 ng/mL each in Isooctane

2,2',3,4,4',5,6-Heptabromodiphenyl ether (#181)

# EPA Method 1614

Responding to the need for the analysis of polybrominated diphenyl ether (PBDE) congeners, the EPA has developed draft Method 1614. Method 1614 is recommended for analysis of aqueous, solid, tissue, and multi-phase environmental samples. Each formulation is prepared using PBDEs which are synthesized and analyzed by AccuStandard.

## Mixtures of PBDEs Standard Solution for Accuracy & Precision

<b>BDE-AAP-A</b>	<b>1 x 1 mL</b>	<b>BDE-AAP-A-15X</b>	<b>1 x 1 mL</b>
<i>At stated conc. in Isooctane</i>	39 comps.	<i>At stated conc. in Isooctane</i>	39 comps.
(BZ#)	ng/mL	(BZ#)	µg/mL
2-Bromodiphenyl ether (#1)	100	2-Bromodiphenyl ether (#1)	1.5
3-Bromodiphenyl ether (#2)	100	3-Bromodiphenyl ether (#2)	1.5
4-Bromodiphenyl ether (#3)	100	4-Bromodiphenyl ether (#3)	1.5
2,4-Dibromodiphenyl ether (#7)	100	2,4-Dibromodiphenyl ether (#7)	1.5
2,4'-Dibromodiphenyl ether (#8)	100	2,4'-Dibromodiphenyl ether (#8)	1.5
2,6-Dibromodiphenyl ether (#10)	100	2,6-Dibromodiphenyl ether (#10)	1.5
3,3'-Dibromodiphenyl ether (#11)	100	3,3'-Dibromodiphenyl ether (#11)	1.5
3,4-Dibromodiphenyl ether (#12)	100	3,4-Dibromodiphenyl ether (#12)	1.5
3,4'-Dibromodiphenyl ether (#13)	100	3,4'-Dibromodiphenyl ether (#13)	1.5
4,4'-Dibromodiphenyl ether (#15)	100	4,4'-Dibromodiphenyl ether (#15)	1.5
2,2',4,-Tribromodiphenyl ether (#17)	100	2,2',4,-Tribromodiphenyl ether (#17)	1.5
2,3',4-Tribromodiphenyl ether (#25)	100	2,3',4-Tribromodiphenyl ether (#25)	1.5
2,4,4'-Tribromodiphenyl ether (#28)	100	2,4,4'-Tribromodiphenyl ether (#28)	1.5
2,4,6-Tribromodiphenyl ether (#30)	100	2,4,6-Tribromodiphenyl ether (#30)	1.5
2,4',6-Tribromodiphenyl ether (#32)	100	2,4',6-Tribromodiphenyl ether (#32)	1.5
2',3,4-Tribromodiphenyl ether (#33)	100	2',3,4-Tribromodiphenyl ether (#33)	1.5
3,3',4-Tribromodiphenyl ether (#35)	100	3,3',4-Tribromodiphenyl ether (#35)	1.5
3,4,4'-Tribromodiphenyl ether (#37)	100	3,4,4'-Tribromodiphenyl ether (#37)	1.5
2,2',4,4'-Tetrabromodiphenyl ether (#47)	100	2,2',4,4'-Tetrabromodiphenyl ether (#47)	1.5
2,2',4,5'-Tetrabromodiphenyl ether (#49)	100	2,2',4,5'-Tetrabromodiphenyl ether (#49)	1.5
2,3',4,4'-Tetrabromodiphenyl ether (#66)	100	2,3',4,4'-Tetrabromodiphenyl ether (#66)	1.5
2,3',4',6-Tetrabromodiphenyl ether (#71)	100	2,3',4',6-Tetrabromodiphenyl ether (#71)	1.5
2,4,4',6-Tetrabromodiphenyl ether (#75)	100	2,4,4',6-Tetrabromodiphenyl ether (#75)	1.5
3,3',4,4'-Tetrabromodiphenyl ether (#77)	100	3,3',4,4'-Tetrabromodiphenyl ether (#77)	1.5
2,2',3,4,4'-Pentabromodiphenyl ether (#85)	150	2,2',3,4,4'-Pentabromodiphenyl ether (#85)	2.25
2,2',4,4',5-Pentabromodiphenyl ether (#99)	150	2,2',4,4',5-Pentabromodiphenyl ether (#99)	2.25
2,2',4,4',6-Pentabromodiphenyl ether (#100)	150	2,2',4,4',6-Pentabromodiphenyl ether (#100)	2.25
2,3,4,5,6-Pentabromodiphenyl ether (#116)	150	2,3,4,5,6-Pentabromodiphenyl ether (#116)	2.25
2,3',4,4',5-Pentabromodiphenyl ether (#118)	150	2,3',4,4',5-Pentabromodiphenyl ether (#118)	2.25
2,3',4,4',6-Pentabromodiphenyl ether (#119)	150	2,3',4,4',6-Pentabromodiphenyl ether (#119)	2.25
3,3',4,4',5-Pentabromodiphenyl ether (#126)	150	3,3',4,4',5-Pentabromodiphenyl ether (#126)	2.25
2,2',3,4,4',5'-Hexabromodiphenyl ether (#138)	200	2,2',3,4,4',5'-Hexabromodiphenyl ether (#138)	3.0
2,2',4,4',5'-Hexabromodiphenyl ether (#153)	200	2,2',4,4',5'-Hexabromodiphenyl ether (#153)	3.0
2,2',4,4',5,6'-Hexabromodiphenyl ether (#154)	200	2,2',4,4',5,6'-Hexabromodiphenyl ether (#154)	3.0
2,2',4,4',6,6'-Hexabromodiphenyl ether (#155)	200	2,2',4,4',6,6'-Hexabromodiphenyl ether (#155)	3.0
2,3,4,4',5,6-Hexabromodiphenyl ether (#166)	200	2,3,4,4',5,6-Hexabromodiphenyl ether (#166)	3.0
2,2',3,4,4',5,6-Heptabromodiphenyl ether (#181)	250	2,2',3,4,4',5,6-Heptabromodiphenyl ether (#181)	3.75
2,2',3,4,4',5',6-Heptabromodiphenyl ether (#183)	250	2,2',3,4,4',5',6-Heptabromodiphenyl ether (#183)	3.75
2,3,3',4,4',5,6-Heptabromodiphenyl ether (#190)	250	2,3,3',4,4',5,6-Heptabromodiphenyl ether (#190)	3.75

## Commonly Occurring PBDE Congeners for Precision & Recovery

<b>BDE-COC</b>	<b>1 x 1 mL</b>
<i>At stated conc. in Isooctane</i>	14 comps.
(BZ#)	µg/mL
2,2',4,-Tribromodiphenyl ether (#17)	5
2,4,4'-Tribromodiphenyl ether (#28)	5
2,2',4,4'-Tetrabromodiphenyl ether (#47)	5
2,3',4,4'-Tetrabromodiphenyl ether (#66)	5
2,3',4',6-Tetrabromodiphenyl ether (#71)	5
2,2',3,4,4'-Pentabromodiphenyl ether (#85)	5
2,2',4,4',5-Pentabromodiphenyl ether (#99)	5
2,2',4,4',6-Pentabromodiphenyl ether (#100)	5
2,2',3,4,4',5'-Hexabromodiphenyl ether (#138)	5
2,2',4,4',5,5'-Hexabromodiphenyl ether (#153)	5
2,2',4,4',5,6'-Hexabromodiphenyl ether (#154)	5
2,2',3,4,4',5',6-Heptabromodiphenyl ether (#183)	5
2,3,3',4,4',5,6-Heptabromodiphenyl ether (#190)	5
Decabromodiphenyl ether (#209)	25

## PBDEs in proposed Method 1614 Set

<b>BDE-EPA-SET</b>	<b>8 x 1 mL</b>
<i>Each in 50 µg/mL in Isooctane</i>	8 comps.
(BZ#)	
2,4,4'-Tribromodiphenyl ether (#28)	BDE-028S
2,2',4,4'-Tetrabromodiphenyl ether (#47)	BDE-047S
2,2',4,4',5-Pentabromodiphenyl ether (#99)	BDE-099S
2,2',4,4',6-Pentabromodiphenyl ether (#100)	BDE-100S
2,2',4,4',5,5'-Hexabromodiphenyl ether (#153)	BDE-153S
2,2',4,4',5,6'-Hexabromodiphenyl ether (#154)	BDE-154S
2,2',3,4,4',5',6-Heptabromodiphenyl ether (#183)	BDE-183S
Decabromodiphenyl ether (#209)	BDE-209S

## PBDE Congeners of Primary Interest

<b>BDE-CSM</b>	<b>1 x 1 mL</b>
<i>At stated conc. in Isooctane</i>	8 comps.
(BZ#)	µg/mL
2,4,4'-Tribromodiphenyl ether (#28)	20
2,2',4,4'-Tetrabromodiphenyl ether (#47)	20
2,2',4,4',5-Pentabromodiphenyl ether (#99)	20
2,2',4,4',6-Pentabromodiphenyl ether (#100)	20
2,2',4,4',5,5'-Hexabromodiphenyl ether (#153)	20
2,2',4,4',5,6'-Hexabromodiphenyl ether (#154)	20
2,2',3,4,4',5',6-Heptabromodiphenyl ether (#183)	20
Decabromodiphenyl ether (#209)	200

## Calibration Mix

<b>BDE-CM</b>	<b>1 x 1 mL</b>
<i>At stated conc. in Isooctane</i>	8 comps.
(BZ#)	µg/mL
2,4,4'-Tribromodiphenyl ether (#28)	2.5
2,2',4,4'-Tetrabromodiphenyl ether (#47)	2.5
2,2',4,4',5-Pentabromodiphenyl ether (#99)	2.5
2,2',4,4',6-Pentabromodiphenyl ether (#100)	2.5
2,2',4,4',5,5'-Hexabromodiphenyl ether (#153)	2.5
2,2',4,4',5,6'-Hexabromodiphenyl ether (#154)	2.5
2,2',3,4,4',5',6-Heptabromodiphenyl ether (#183)	2.5
Decabromodiphenyl ether (#209)	25

## Matrix Spiking Solution

<b>BDE-MS</b>	<b>1 x 1 mL</b>
<i>At stated conc. in Isooctane</i>	8 comps.
(BZ#)	ng/mL
2,4,4'-Tribromodiphenyl ether (#28)	1
2,2',4,4'-Tetrabromodiphenyl ether (#47)	1
2,2',4,4',5-Pentabromodiphenyl ether (#99)	1
2,2',4,4',6-Pentabromodiphenyl ether (#100)	1
2,2',4,4',5,5'-Hexabromodiphenyl ether (#153)	1
2,2',4,4',5,6'-Hexabromodiphenyl ether (#154)	1
2,2',3,4,4',5',6-Heptabromodiphenyl ether (#183)	1
Decabromodiphenyl ether (#209)	10



# Hydroxy & Methoxy PBDEs

Hydroxylated and methoxylated PBDEs may be formed as metabolites of the widely used PBDE flame retardants. AccuStandard's aim is to synthesize authentic OH- and MeO-PBDE reference standards for analytical and toxicological studies. Since this is an ongoing project, please check the website for the latest update of this list.

SHORT FORM	COMPOUND	QTY./CONC.	MATRIX	CAT. NO.	UNIT
2'-OH-BDE-003	2'-Hydroxy-4-monobromodiphenyl ether	50 µg/mL	Acetonitrile	HBDE-1001S-CN	1 mL
3'-OH-BDE-007	3'-Hydroxy-2,4-dibromodiphenyl ether	50 µg/mL	Acetonitrile	HBDE-2001S-CN	1 mL
2'-OH-BDE-007	2'-Hydroxy-2,4-dibromodiphenyl ether	10 µg/mL	Acetonitrile	HBDE-2002S-CN-0.2X	1 mL
4'-OH-BDE-017	4'-Hydroxy-2,2',4,4'-tribromodiphenyl ether	50 µg/mL	Acetonitrile	HBDE-3001S-CN	1 mL
3'-OH-BDE-028	3'-Hydroxy-2,4,4'-tribromodiphenyl ether	50 µg/mL	Acetonitrile	HBDE-3002S-CN	1 mL
3'-OH-BDE-028	2'-Hydroxy-2,4,4'-tribromodiphenyl ether	50 µg/mL	Acetonitrile	HBDE-3003S-CN	1 mL
4'-OH-BDE-042	4'-Hydroxy-2,2',3,4,4'-tetrabromodiphenyl ether	10 µg/mL	Acetonitrile	HBDE-4001S-CN-0.2X	1 mL
4'-OH-BDE-049	4'-Hydroxy-2,2',4,5'-tetrabromodiphenyl ether	10 µg/mL	Acetonitrile	HBDE-4002S-CN-0.2X	1 mL
3'-OH-BDE-047	3'-Hydroxy-2,2',4,4'-tetrabromodiphenyl ether	50 µg/mL	Acetonitrile	HBDE-4003S-CN	1 mL
5'-OH-BDE-047	5'-Hydroxy-2,2',4,4'-tetrabromodiphenyl ether	50 µg/mL	Acetonitrile	HBDE-4004S-CN	1 mL
6'-OH-BDE-047	6'-Hydroxy-2,2',4,4'-tetrabromodiphenyl ether	10 µg/mL	Acetonitrile	HBDE-4005S-CN-0.2X	1 mL
2'-OH-BDE-068	2'-Hydroxy-2,3',4,5'-tetrabromodiphenyl ether <b>NEW</b>	10 µg/mL	Acetonitrile	HBDE-4006S-CN-0.2X	1 mL
		50 µg/mL	Acetonitrile	HBDE-4006S-CN	1 mL
2'-OH-BDE-075	2'-Hydroxy-2,4,4',6-tetrabromodiphenyl ether <b>NEW</b>	10 µg/mL	Acetonitrile	HBDE-4007S-CN-0.2X	1 mL
		50 µg/mL	Acetonitrile	HBDE-4007S-CN	1 mL
4'-OH-BDE-090	4'-Hydroxy-2,2',3,4',5-pentabromodiphenyl ether	10 µg/mL	Acetonitrile	HBDE-5001S-CN-0.2X	1 mL
6'-OH-BDE-085	6'-Hydroxy-2,2',3,4,4'-pentabromodiphenyl ether	10 µg/mL	Acetonitrile	HBDE-5002S-CN-0.2X	1 mL
6'-OH-BDE-087	6'-Hydroxy-2,2',3,4,5'-pentabromodiphenyl ether	10 µg/mL	Acetonitrile	HBDE-5003S-CN-0.2X	1 mL
6'-OH-BDE-082	6'-Hydroxy-2,2',3,3',4-pentabromodiphenyl ether	10 µg/mL	Acetonitrile	HBDE-5005S-CN-0.2X	1 mL
6'-OH-BDE-099	6'-Hydroxy-2,2',4,4',5-pentabromodiphenyl ether	10 µg/mL	Acetonitrile	HBDE-5006S-CN-0.2X	1 mL
5'-OH-BDE-099	5'-Hydroxy-2,2',4,4',5-pentabromodiphenyl ether	10 µg/mL	Acetonitrile	HBDE-5007S-CN-0.2X	1 mL
6'-OH-BDE-157	6'-Hydroxy-2,3,3',4,4',5'-hexabromodiphenyl ether	10 µg/mL	Acetonitrile	HBDE-6001S-CN-0.2X	1 mL
6'-OH-BDE-140	6'-Hydroxy-2,2',3,4,4',6'-hexabromodiphenyl ether	10 µg/mL	Acetonitrile	HBDE-6002S-CN-0.2X	1 mL
3'-OH-BDE-154	3'-Hydroxy-2,2',4,4',5',6-hexabromodiphenyl ether	10 µg/mL	Acetonitrile	HBDE-6003S-CN-0.2X	1 mL
2'-MeO-BDE-003	2'-Methoxy-4-monobromodiphenyl ether	50 µg/mL	Methanol	MOBDE-1001S	1 mL
3'-MeO-BDE-007	3'-Methoxy-2,4-dibromodiphenyl ether	50 µg/mL	Methanol	MOBDE-2001S	1 mL
2'-MeO-BDE-007	2'-Methoxy-2,4-dibromodiphenyl ether	10 µg/mL	Methanol	MOBDE-2002S-0.2X	1 mL
4'-MeO-BDE-017	4'-Methoxy-2,2',4-tribromodiphenyl ether	50 µg/mL	Methanol	MOBDE-3001S	1 mL
3'-MeO-BDE-028	3'-Methoxy-2,4,4'-tribromodiphenyl ether	50 µg/mL	Methanol	MOBDE-3002S	1 mL
2'-MeO-BDE-028	2'-Methoxy-2,4,4'-tribromodiphenyl ether	50 µg/mL	Methanol	MOBDE-3003S	1 mL
4'-MeO-BDE-042	4'-Methoxy-2,2',3,4,4'-tetrabromodiphenyl ether	10 µg/mL	Methanol	MOBDE-4001S-0.2X	1 mL
4'-MeO-BDE-049	4'-Methoxy-2,2',4,5'-tetrabromodiphenyl ether	10 µg/mL	Methanol	MOBDE-4002S-0.2X	1 mL
3'-MeO-BDE-047	3'-Methoxy-2,2',4,4'-tetrabromodiphenyl ether	50 µg/mL	Methanol	MOBDE-4003S	1 mL
5'-MeO-BDE-047	5'-Methoxy-2,2',4,4'-tetrabromodiphenyl ether	50 µg/mL	Methanol	MOBDE-4004S	1 mL
6'-MeO-BDE-047	6'-Methoxy-2,2',4,4'-tetrabromodiphenyl ether	10 µg/mL	Methanol	MOBDE-4005S-0.2X	1 mL
2'-MeO-BDE-068	2'-Methoxy-2,3',4,5'-tetrabromodiphenyl ether <b>NEW</b>	10 µg/mL	Methanol	MOBDE-4006S-0.2X	1 mL
2'-MeO-BDE-075	2'-Methoxy-2,4,4',6-tetrabromodiphenyl ether <b>NEW</b>	50 µg/mL	Methanol	MOBDE-4007S	1 mL
4'-MeO-BDE-090	4'-Methoxy-2,2',3,4',5-pentabromodiphenyl ether	10 µg/mL	Methanol	MOBDE-5001S-0.2X	1 mL
6'-MeO-BDE-085	6'-Methoxy-2,2',3,4,4'-pentabromodiphenyl ether	10 µg/mL	Methanol	MOBDE-5002S-0.2X	1 mL
6'-MeO-BDE-087	6'-Methoxy-2,2',3,4,5'-pentabromodiphenyl ether	10 µg/mL	Methanol	MOBDE-5003S-0.2X	1 mL
6'-MeO-BDE-082	6'-Methoxy-2,2',3,3',4-pentabromodiphenyl ether	10 µg/mL	Methanol	MOBDE-5005S-0.2X	1 mL
6'-MeO-BDE-099	6'-Methoxy-2,2',4,4',5-pentabromodiphenyl ether	10 µg/mL	Methanol	MOBDE-5006S-0.2X	1 mL
5'-MeO-BDE-099	5'-Methoxy-2,2',4,4',5-pentabromodiphenyl ether	10 µg/mL	Methanol	MOBDE-5007S-0.2X	1 mL
6'-MeO-BDE-157	6'-Methoxy-2,3,3',4,4',5'-hexabromodiphenyl ether	10 µg/mL	Methanol	MOBDE-6001S-0.2X	1 mL
6'-MeO-BDE-140	6'-Methoxy-2,2',3,4,4',6'-hexabromodiphenyl ether	10 µg/mL	Methanol	MOBDE-6002S-0.2X	1 mL
3'-MeO-BDE-154	3'-Methoxy-2,2',4,4',5',6-hexabromodiphenyl ether	10 µg/mL	Methanol	MOBDE-6003S-0.2X	1 mL

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# Other Flame Retardants

## Individual Flame Retardants

COMPOUND	CAS NO.	ACTIVE INGREDIENT	QTY./CONC.	MATRIX	CAT. NO.	UNIT
<b>Bromine containing Flame Retardants</b>						
4-Bromophenyl phenyl ether	101-55-3		100 µg/mL 5 mg/mL	MeOH MeOH	APP-9-033 AS-E0039	1 mL 1 mL
Dow FR-250	27858-07-7	Octabromobiphenyl	10 mg 100 µg/mL 35 µg/mL	NEAT Isooctane Isooctane	B-250N B-250S B-250S-0.35X	10 mg 1 mL 1 mL
Firemaster™ BP4A	79-94-7	Tetrabromobisphenol A	10 mg 100 µg/mL	NEAT Toluene	FRS-006N FRS-006S	10 mg 1 mL
Firemaster BP-6	59536-65-1	Hexabromobiphenyl	10 mg 35 µg/mL 100 µg/mL	NEAT Isooctane Isooctane	B-600N B-600S-0.35X B-600S	10 mg 1 mL 1 mL
Firemaster PHT4	632-79-1	Tetrabromophthalic anhydride	10 mg 100 µg/mL	NEAT Toluene	FRS-007N FRS-007S	10 mg 1 mL
Firemaster T23P		Tris(2,3-dibromopropyl)phosphate	10 mg 100 µg/mL	NEAT Toluene	FRS-008N FRS-008S	10 mg 1 mL
Firemaster 680 (Tech grade) <b>NEW</b>	37853-59-1	1,2-Bis(2,4,6-tribromophenoxy)ethane	50 mg 100 µg/mL	NEAT Toluene	FRS-037N FRS-037S	50 mg 1 mL
Firemaster 2100 (Tech grade) <b>NEW</b>		Decabromodiphenylethane	50 mg	NEAT	FRS-036N	50 mg
FR-300BA (Deca)	1163-19-5	Decabromodiphenyl oxide 85.5%	10 mg 100 µg/mL	NEAT Toluene	FRS-009N FRS-009S	10 mg 1 mL
FR-651A	87-84-3	Pentabromochlorocyclohexane	10 mg 100 µg/mL	NEAT Toluene	FRS-010N FRS-010S	10 mg 1 mL
FR-1138	3296-90-0	Dibromoneopentyl glycol 85.0%	10 mg 100 µg/mL	NEAT Toluene	FRS-011N FRS-011S	10 mg 1 mL
Hexabromobenzene (mich)	87-82-1	Hexabromobenzene (Michigan Chemical)	10 mg 100 µg/mL	NEAT Toluene	FRS-012N FRS-012S	10 mg 1 mL
Hexabromobenzene (white)	87-82-1	Hexabromobenzene (White Chemical)	10 mg 100 µg/mL	NEAT Toluene	FRS-013N FRS-013S	10 mg 1 mL
Pentabromobenzylacrylate (Tech) <b>NEW</b>	59447-55-1	Pentabromobenzylacrylate	10 mg 100 µg/mL	NEAT Toluene	FRS-035N FRS-035S	10 mg 1 mL
Pentabromobenzylbromide (Tech) <b>NEW</b>	1163-19-5	Pentabromobenzylbromide	10 mg 100 µg/mL	NEAT Toluene	FRS-030N FRS-030S	10 mg 1 mL
Pentabromotoluene	87-83-2	Pentabromotoluene	10 mg 100 µg/mL	NEAT Toluene	FRS-018N FRS-018S	10 mg 1 mL
Tetrabromobisphenol A bis(hydroxyethyl ether) (Tech) <b>NEW</b>	4162-45-2	Tetrabromobisphenol A bis(hydroxyethyl ether)	50 mg 100 µg/mL	NEAT Toluene	FRS-038N FRS-038S	50 mg 1 mL
Tetrabromo-o-chlorotoluene		Tetrabromo-o-chlorotoluene	10 mg 100 µg/mL	NEAT Toluene	FRS-021N FRS-021S	10 mg 1 mL
TP-69		Tris(2,3-dibromopropyl)phosphate	10 mg 100 µg/mL	NEAT Toluene	FRS-023N FRS-023S	10 mg 1 mL
<b>Other Flame Retardants</b>						
Chlorafin™ 40	63449-39-8	Chlorinated Paraffin	10 mg 100 µg/mL	NEAT Toluene	FRS-002N FRS-002S	10 mg 1 mL
Chlorendic anhydride	115-27-5	Chlorendic anhydride	10 mg 100 µg/mL	NEAT Toluene	FRS-001N FRS-001S	10 mg 1 mL
bis(2-Chloroethyl)ether	111-44-4		100 µg/mL 5 mg/mL	MeOH MeOH	APP-9-027 AS-E0016	1 mL 1 mL
4-Chlorophenyl phenyl ether	7005-72-3		100 µg/mL 5 mg/mL	MeOH MeOH	APP-9-047 AS-E0038	1 mL 1 mL
Chlorowax™ 500C	63449-39-8	Chlorinated Hydrocarbons 59.0%	10 mg 100 µg/mL	NEAT Toluene	FRS-004N FRS-004S	10 mg 1 mL
Diable 700X		Chlorinated Hydrocarbons 70.0%	10 mg 100 µg/mL	NEAT Toluene	FRS-005N FRS-005S	10 mg 1 mL
Hexachlorobutadiene	87-68-3	Hexachlorobutadiene	10 mg 100 µg/mL	NEAT Toluene	FRS-017N FRS-017S	10 mg 1 mL
Paroil™ 179-HV	63449-39-8		10 mg 100 µg/mL	NEAT Toluene	FRS-015N FRS-015S	10 mg 1 mL
Paroil 170-8	63449-39-8		10 mg 100 µg/mL	NEAT Toluene	FRS-016N FRS-016S	10 mg 1 mL
Phosgard™ C 22-R	4351-70-6	Halogenated organic phosphate ester	10 mg 100 µg/mL	NEAT Toluene	FRS-019N FRS-019S	10 mg 1 mL
Phosgard 2XC-20		Halogenated organic phosphate ester	10 mg 100 µg/mL	NEAT Toluene	FRS-020N FRS-020S	10 mg 1 mL
Tetrachlorobisphenol A	79-95-8	Tetrachlorobisphenol A	10 mg 100 µg/mL	NEAT Toluene	FRS-022N FRS-022S	10 mg 1 mL
Unichlor™ 40-90	63449-39-8	Chlorinated Hydrocarbons 38.5%	10 mg 100 µg/mL	NEAT Toluene	FRS-024N FRS-024S	10 mg 1 mL
Unichlor 502-50	63449-39-8	Chlorinated Hydrocarbons 52.0%	10 mg 100 µg/mL	NEAT Toluene	FRS-025N FRS-025S	10 mg 1 mL
Unichlor 70AX	63449-39-8	Chlorinated Hydrocarbons 70.0%	10 mg 100 µg/mL	NEAT Toluene	FRS-026N FRS-026S	10 mg 1 mL

### Registered Trademarks

Chlorafin	Hercules Powder Company Corp.	Paroil	Dover Chemical Corp
Chlorowax	Dover Chemical Corp.	Phosgard	Solutia Inc.
Firemaster	Great Lakes Chemical Corp.	Unichlor	Neville Chemical Co.

# Bromobiphenyls

## Individual Bromobiphenyl Congeners

COMPOUND	CAS NO.	QTY./CONC.	MATRIX	CAT. NO.	UNIT
2-Bromobiphenyl	2052-07-5	50 mg	NEAT	B-001N	50 mg
		35 µg/mL	Isooctane	B-001S	1 mL
		1 mg/mL	Acetone	M-8081-SS-X	1 mL
3-Bromobiphenyl	2113-57-7	50 mg	NEAT	B-002N	50 mg
		35 µg/mL	Isooctane	B-002S	1 mL
		50 mg	NEAT	B-003N	50 mg
4-Bromobiphenyl	92-66-0	35 µg/mL	Isooctane	B-003S	1 mL
		10 mg	NEAT	B-004N	10 mg
		35 µg/mL	Isooctane	B-004S	1 mL
2,4-Dibromobiphenyl	53592-10-2	25 mg	NEAT	B-007N	25 mg
		35 µg/mL	Isooctane	B-007S	1 mL
		25 mg	NEAT	B-009N	25 mg
2,5-Dibromobiphenyl	57422-77-2	35 µg/mL	Isooctane	B-009S	1 mL
		10 mg	NEAT	B-010N	10 mg
		35 µg/mL	Isooctane	B-010S	1 mL
4,4'-Dibromobiphenyl	92-86-4	10 mg	NEAT	B-015N	10 mg
		35 µg/mL	Isooctane	B-015S	1 mL
		10 mg	NEAT	B-153N	10 mg
2,2',4,4',5,5'-Hexabromobiphenyl	59080-40-9	35 µg/mL	Isooctane	B-153S	1 mL
		5 mg	NEAT	B-155N	5 mg
		35 µg/mL	Isooctane	B-155S	1 mL
3,3',4,4',5,5'-Hexabromobiphenyl	77607-09-1	35 µg/mL	Isooctane	B-169S	1 mL
2,2',4,5,5'-Pentabromobiphenyl	67888-96-4	35 µg/mL	Isooctane	B-101S	1 mL
2,2',4,5'-Tetrabromobiphenyl	60044-24-8	10 mg	NEAT	B-049N	10 mg
		35 µg/mL	Isooctane	B-049S	1 mL
		10 mg	NEAT	B-052N	10 mg
2,2',5,5'-Tetrabromobiphenyl	59080-37-4	35 µg/mL	Isooctane	B-052S	1 mL
		10 mg	NEAT	B-053N	10 mg
		35 µg/mL	Isooctane	B-053S	1 mL
3,3',4,4'-Tetrabromobiphenyl	77102-82-0	35 µg/mL	Isooctane	B-077S	1 mL
3,3',5,5'-Tetrabromobiphenyl	16400-50-3	35 µg/mL	Isooctane	B-080S	1 mL
2,2',5-Tribromobiphenyl	59080-34-1	10 mg	NEAT	B-018N	10 mg
		35 µg/mL	Isooctane	B-018S	1 mL
		10 mg	NEAT	B-026N	10 mg
2,3',5-Tribromobiphenyl	59080-35-2	35 µg/mL	Isooctane	B-026S	1 mL
		25 mg	NEAT	B-030N	25 mg
		35 µg/mL	Isooctane	B-030S	1 mL
2,4,6-Tribromobiphenyl	59080-33-0	10 mg	NEAT	B-031N	10 mg
		35 µg/mL	Isooctane	B-031S	1 mL
		10 mg	NEAT	B-031N	10 mg
2,4',5-Tribromobiphenyl	59080-35-3	35 µg/mL	Isooctane	B-031S	1 mL

## Custom Synthesis

The AccuStandard Synthesis Department employs PhD Organic Chemists with many years of academic and industrial experience. This experienced staff has developed hundreds of pure chemical compounds for companies and governmental agencies around the world. The well equipped synthetic laboratory has made many notable synthesis projects possible. We specialize in synthesizing chemicals of high purity to be used as reference standards, and we offer custom synthesis capability for milligram to kilogram batches. AccuStandard is the only company to synthesize all 209 individual PCB congeners as well as over 170 individual PBDE congeners.



### Synthesis Experience

PCBs (all 209 congeners), PBBs  
 PCB Metabolites  
 Explosives - TNT, RDX, HMX, TATP, HND, HMTD  
 PBDEs (over 170 congeners)  
 PBDE Metabolites  
 Halo-Dibenzodioxins  
 Halo-Dibenzofurans  
 PAHs, Nitro-PAHs  
 Halodiphenylethers  
 Pesticides and Metabolites  
 Forensics  
 Wear Metals  
 Pharmaceuticals  
 Other Rare Chemicals

### Lab Resources

Milligram to Kilogram Scale Glassware  
 Equipment to work under N<sub>2</sub>/Ar  
 Liquid Solid Phase Chrom. (mg to 2 kg)  
 Flash Chrom. (mg to 2 kg) including Horizon  
 High Performance Flash Chrom. System  
 Preparative TLC  
 Buchi Rotary Evaporators  
 Vacuum Drying Oven  
 Parr Pressure Reactor (high pressure reaction, hydrogenation)  
 Distillation Equipment - High Vacuum Distillation, Molecular Distillation (Kugelrohr), and Spinning Band Columns

### Analytical Resources

H-NMR spectrometer - 400 MHZ  
 GC/MS, GC/FID, GC/ECD, GC/NPD  
 HPLC  
 ICP  
 Low Sulfur Analyzers (Antek, X-Ray Optical)  
 LC/MS/MS  
 Hg Analyzer



Manufactured by



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