

# Flame Retardants

There are 209 congeners of the PBDEs (Polybrominated Diphenyl Ethers) many of which are contained in the technical mixtures that are used as flame-retardants. The congeners that are the major constituents of commercial flame-retardants are PBDE congener numbers 28, 47, 99, 100, 153, 154, 183 and 209. There are however minor congener constituents that are even more toxic.

PBDEs attract the same kind of attention as PCBs (Polychlorinated Biphenyls) being ubiquitous in the environment and similarly persistent.

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 150 PBDE congeners. New congeners, as well as selected metabolites are currently under development. See how we can meet your specific analytical needs, contact us by phone or e-mail at techservice@accustandard.com.

Flame Retardant Standards are listed as follows:

- Individual Polybrominated Diphenyl Ethers (PBDEs)
- PBDE Metabolites (Hydroxy and Methoxy Derivatives)
- Bromobiphenyl Congeners
- Other Flame Retardants
- PBDEs Selected Mixtures



## Polybrominated Diphenyl Ethers (PBDEs)

Individual PBDEs Standards (in 1 mL of solvent, unless otherwise noted)

| PBDEs                              | CAS NO.     | QTY./CONC. | MATRIX    | CAT. NO. |
|------------------------------------|-------------|------------|-----------|----------|
| 2-Bromodiphenyl ether              |             | 50 µg/mL   | Isooctane | BDE-001S |
| 3-Bromodiphenyl ether              |             | 50 µg/mL   | Isooctane | BDE-002S |
| 4-Bromodiphenyl ether              | 101-55-3    | 50 µg/mL   | Isooctane | BDE-003S |
| 2,2'-Dibromodiphenyl ether         |             | 50 µg/mL   | Isooctane | BDE-004S |
| 2,3-Dibromodiphenyl ether          |             | 50 µg/mL   | Isooctane | BDE-005S |
| 2,3'-Dibromodiphenyl ether         |             | 50 µg/mL   | Isooctane | BDE-006S |
| 2,4-Dibromodiphenyl ether          |             | 50 µg/mL   | Isooctane | BDE-007S |
| 2,4'-Dibromodiphenyl ether         |             | 50 µg/mL   | Isooctane | BDE-008S |
| 2,5-Dibromodiphenyl ether          |             | 50 µg/mL   | Isooctane | BDE-009S |
| 2,6-Dibromodiphenyl ether          |             | 50 µg/mL   | Isooctane | BDE-010S |
| 3,3'-Dibromodiphenyl ether         |             | 50 µg/mL   | Isooctane | BDE-011S |
| 3,4-Dibromodiphenyl ether          |             | 50 µg/mL   | Isooctane | BDE-012S |
| 3,4'-Dibromodiphenyl ether         |             | 50 µg/mL   | Isooctane | BDE-013S |
| 3,5-Dibromodiphenyl ether          |             | 50 µg/mL   | Isooctane | BDE-014S |
| 4,4'-Dibromodiphenyl ether         | 2050-47-7   | 50 µg/mL   | Isooctane | BDE-015S |
| 2,2',3-Tribromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-016S |
| 2,2',4,-Tribromodiphenyl ether     |             | 50 µg/mL   | Isooctane | BDE-017S |
| 2,2',5-Tribromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-018S |
| 2,2',6-Tribromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-019S |
| 2,3,3'-Tribromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-020S |
| 2,3,4-Tribromodiphenyl ether       |             | 50 µg/mL   | Isooctane | BDE-021S |
| 2,3,4'-Tribromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-022S |
| 2,3,5-Tribromodiphenyl ether       |             | 50 µg/mL   | Isooctane | BDE-023S |
| 2,3',4-Tribromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-025S |
| 2,3',5-Tribromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-026S |
| 2,3',6-Tribromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-027S |
| 2,4,4'-Tribromodiphenyl ether      | 41318-75-6  | 50 µg/mL   | Isooctane | BDE-028S |
| 2,4,5-Tribromodiphenyl ether       |             | 50 µg/mL   | Isooctane | BDE-029S |
| 2,4,6-Tribromodiphenyl ether       |             | 50 µg/mL   | Isooctane | BDE-030S |
| 2,4',5-Tribromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-031S |
| 2,4',6-Tribromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-032S |
| 2',3,4-Tribromodiphenyl ether      | 147217-78-5 | 50 µg/mL   | Isooctane | BDE-033S |
| 2',3,5-Tribromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-034S |
| 3,3',4-Tribromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-035S |
| 3,3',5-Tribromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-036S |
| 3,4,4'-Tribromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-037S |
| 3,4,5-Tribromodiphenyl ether       |             | 50 µg/mL   | Isooctane | BDE-038S |
| 3,4',5-Tribromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-039S |
| 2,2',3,3'-Tetrabromodiphenyl ether |             | 50 µg/mL   | Isooctane | BDE-040S |
| 2,2',3,4-Tetrabromodiphenyl ether  |             | 50 µg/mL   | Isooctane | BDE-041S |
| 2,2',3,4'-Tetrabromodiphenyl ether |             | 50 µg/mL   | Isooctane | BDE-042S |
| 2,2',3,5-Tetrabromodiphenyl ether  |             | 50 µg/mL   | Isooctane | BDE-043S |
| 2,2',3,6-Tetrabromodiphenyl ether  |             | 50 µg/mL   | Isooctane | BDE-046S |
| 2,2',4,4'-Tetrabromodiphenyl ether | 5436-43-1   | 50 µg/mL   | Isooctane | BDE-047S |
| 2,2',4,5-Tetrabromodiphenyl ether  |             | 50 µg/mL   | Isooctane | BDE-048S |
| 2,2',4,5'-Tetrabromodiphenyl ether |             | 50 µg/mL   | Isooctane | BDE-049S |
| 2,2',4,6-Tetrabromodiphenyl ether  |             | 50 µg/mL   | Isooctane | BDE-050S |
| 2,2',4,6'-Tetrabromodiphenyl ether |             | 50 µg/mL   | Isooctane | BDE-051S |
| 2,2',5,6'-Tetrabromodiphenyl ether |             | 50 µg/mL   | Isooctane | BDE-053S |
| 2,3,3',4-Tetrabromodiphenyl ether  |             | 50 µg/mL   | Isooctane | BDE-055S |
| 2,3,3',5-Tetrabromodiphenyl ether  |             | 50 µg/mL   | Isooctane | BDE-057S |
| 2,3,3',5'-Tetrabromodiphenyl ether |             | 50 µg/mL   | Isooctane | BDE-058S |
| 2,3,4,4'-Tetrabromodiphenyl ether  |             | 50 µg/mL   | Isooctane | BDE-060S |
| 2,3,4,5-Tetrabromodiphenyl ether   |             | 50 µg/mL   | Isooctane | BDE-061S |
| 2,3,4,6-Tetrabromodiphenyl ether   |             | 50 µg/mL   | Isooctane | BDE-062S |
| 2,3,4',5-Tetrabromodiphenyl ether  |             | 50 µg/mL   | Isooctane | BDE-063S |

# Flame Retardants

Individual PBDEs Standards (in 1 mL of solvent, unless otherwise noted)

| PBDEs                                     | CAS NO.     | QTY./CONC. | MATRIX    | CAT. NO. |
|---|-------------|------------|-----------|----------|
| 2,3',4,4'-Tetrabromodiphenyl ether        | 189084-61-5 | 50 µg/mL   | Isooctane | BDE-066S |
| 2,3',4,5-Tetrabromodiphenyl ether         |             | 50 µg/mL   | Isooctane | BDE-067S |
| 2,3',4,5'-Tetrabromodiphenyl ether        |             | 50 µg/mL   | Isooctane | BDE-068S |
| 2,3',4,6-Tetrabromodiphenyl ether         |             | 50 µg/mL   | Isooctane | BDE-069S |
| 2,3',4',6-Tetrabromodiphenyl ether        |             | 50 µg/mL   | Isooctane | BDE-071S |
| 2,3',5,5'-Tetrabromodiphenyl ether        |             | 50 µg/mL   | Isooctane | BDE-072S |
| 2,3',5',6-Tetrabromodiphenyl ether        |             | 50 µg/mL   | Isooctane | BDE-073S |
| 2,4,4',5-Tetrabromodiphenyl ether         |             | 50 µg/mL   | Isooctane | BDE-074S |
| 2,4,4',6-Tetrabromodiphenyl ether         |             | 50 µg/mL   | Isooctane | BDE-075S |
| 2',3,4,5-Tetrabromodiphenyl ether         |             | 50 µg/mL   | Isooctane | BDE-076S |
| 3,3',4,4'-Tetrabromodiphenyl ether        |             | 50 µg/mL   | Isooctane | BDE-077S |
| 3,3',4,5-Tetrabromodiphenyl ether         |             | 50 µg/mL   | Isooctane | BDE-078S |
| 3,3',4,5'-Tetrabromodiphenyl ether        |             | 50 µg/mL   | Isooctane | BDE-079S |
| 3,3',5,5'-Tetrabromodiphenyl ether        |             | 50 µg/mL   | Isooctane | BDE-080S |
| 3,4,4',5-Tetrabromodiphenyl ether         |             | 50 µg/mL   | Isooctane | BDE-081S |
| 2,2',3,3',5-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-083S |
| 2,2',3,4,4'-Pentabromodiphenyl ether      | 182346-21-0 | 50 µg/mL   | Isooctane | BDE-085S |
| 2,2',3,4,5-Pentabromodiphenyl ether       |             | 50 µg/mL   | Isooctane | BDE-086S |
| 2,2',3,4,5'-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-087S |
| 2,2',3,4,6-Pentabromodiphenyl ether       |             | 50 µg/mL   | Isooctane | BDE-088S |
| 2,2',3,4',5-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-090S |
| 2,2',3,5,5'-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-092S |
| 2,2',3,5,6'-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-094S |
| 2,2',3',4,5-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-097S |
| 2,2',3',4,6-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-098S |
| 2,2',4,4',5-Pentabromodiphenyl ether      | 60348-60-9  | 50 µg/mL   | Isooctane | BDE-099S |
| 2,2',4,4',6-Pentabromodiphenyl ether      | 189084-64-8 | 50 µg/mL   | Isooctane | BDE-100S |
| 2,2',4,5,5'-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-101S |
| 2,2',4,5,6'-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-102S |
| 2,2',4,5',6-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-103S |
| 2,2',4,6,6'-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-104S |
| 2,3,3',4,4'-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-105S |
| 2,3,3',4,5-Pentabromodiphenyl ether       |             | 50 µg/mL   | Isooctane | BDE-106S |
| 2,3,3',4,5'-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-108S |
| 2,3,3',4,6-Pentabromodiphenyl ether       |             | 50 µg/mL   | Isooctane | BDE-109S |
| 2,3,3',5,5'-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-111S |
| 2,3,4,4',5-Pentabromodiphenyl ether       |             | 50 µg/mL   | Isooctane | BDE-114S |
| 2,3,4,4',6-Pentabromodiphenyl ether       |             | 50 µg/mL   | Isooctane | BDE-115S |
| 2,3,4,5,6-Pentabromodiphenyl ether        |             | 50 µg/mL   | Isooctane | BDE-116S |
| 2,3',4,4',5-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-118S |
| 2,3',4,4',6-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-119S |
| 2,3',4,5,5'-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-120S |
| 2,3',4,5',6-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-121S |
| 2',3,3',4,5-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-122S |
| 2',3,4,4',5-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-123S |
| 2',3,4,5,5'-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-124S |
| 2',3,4,5,6'-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-125S |
| 3,3',4,4',5-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-126S |
| 3,3',4,5,5'-Pentabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-127S |
| 2,2',3,3',4,4'-Hexabromodiphenyl ether    |             | 50 µg/mL   | Isooctane | BDE-128S |
| 2,2',3,3',4,5'-Hexabromodiphenyl ether    |             | 50 µg/mL   | Isooctane | BDE-130S |
| 2,2',3,3',4,6-Hexabromodiphenyl ether     |             | 50 µg/mL   | Isooctane | BDE-131S |
| 2,2',3,3',6,6'-Hexabromodiphenyl ether    |             | 50 µg/mL   | Isooctane | BDE-136S |
| 2,2',3,4,4',5-Hexabromodiphenyl ether     |             | 50 µg/mL   | Isooctane | BDE-137S |
| 2,2',3,4,4',5'-Hexabromodiphenyl ether    | 182677-30-1 | 50 µg/mL   | Isooctane | BDE-138S |
| 2,2',3,4,4',6-Hexabromodiphenyl ether     |             | 50 µg/mL   | Isooctane | BDE-139S |
| 2,2',3,4,4',6'-Hexabromodiphenyl ether    |             | 50 µg/mL   | Isooctane | BDE-140S |
| 2,2',3,4,5,5'-Hexabromodiphenyl ether     |             | 50 µg/mL   | Isooctane | BDE-141S |
| 2,2',3,4,5,6-Hexabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-142S |
| 2,2',3,4,5',6-Hexabromodiphenyl ether     |             | 50 µg/mL   | Isooctane | BDE-144S |
| 2,2',3,4',5,5'-Hexabromodiphenyl ether    |             | 50 µg/mL   | Isooctane | BDE-146S |
| 2,2',3,4',5,6'-Hexabromodiphenyl ether    |             | 50 µg/mL   | Isooctane | BDE-148S |
| 2,2',4,4',5,5'-Hexabromodiphenyl ether    | 68631-49-2  | 50 µg/mL   | Isooctane | BDE-153S |
| 2,2',4,4',5,6'-Hexabromodiphenyl ether    | 207122-15-4 | 50 µg/mL   | Isooctane | BDE-154S |
| 2,2',4,4',6,6'-Hexabromodiphenyl ether    |             | 50 µg/mL   | Isooctane | BDE-155S |
| 2,3,3',4,4',5-Hexabromodiphenyl ether     |             | 50 µg/mL   | Isooctane | BDE-156S |
| 2,3,3',4,4',5'-Hexabromodiphenyl ether    |             | 50 µg/mL   | Isooctane | BDE-157S |
| 2,3,3',4,4',6-Hexabromodiphenyl ether     |             | 50 µg/mL   | Isooctane | BDE-158S |
| 2,3,3',4,5,5'-Hexabromodiphenyl ether     |             | 50 µg/mL   | Isooctane | BDE-159S |
| 2,3,3',4,5,6-Hexabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-160S |
| 2,3,3',4,5',6-Hexabromodiphenyl ether     |             | 50 µg/mL   | Isooctane | BDE-161S |
| 2,3,3',4',5,5'-Hexabromodiphenyl ether    |             | 50 µg/mL   | Isooctane | BDE-162S |
| 2,3,4,4',5,6-Hexabromodiphenyl ether      |             | 50 µg/mL   | Isooctane | BDE-166S |
| 2,3',4,4',5,5'-Hexabromodiphenyl ether    |             | 50 µg/mL   | Isooctane | BDE-167S |
| 2,3',4,4',5',6-Hexabromodiphenyl ether    |             | 50 µg/mL   | Isooctane | BDE-168S |
| 2,2',3,3',4,5,5'-Heptabromodiphenyl ether |             | 50 µg/mL   | Isooctane | BDE-172S |
| 2,2',3,3',4,5,6-Heptabromodiphenyl ether  |             | 50 µg/mL   | Isooctane | BDE-173S |
| 2,2',3,3',4,5',6-Heptabromodiphenyl ether |             | 50 µg/mL   | Isooctane | BDE-175S |
| 2,2',3,4,4',5,5'-Heptabromodiphenyl ether |             | 50 µg/mL   | Isooctane | BDE-180S |
| 2,2',3,4,4',5,6-Heptabromodiphenyl ether  |             | 50 µg/mL   | Isooctane | BDE-181S |
| 2,2',3,4,4',5,6'-Heptabromodiphenyl ether |             | 50 µg/mL   | Isooctane | BDE-182S |
| 2,2',3,4,4',5',6-Heptabromodiphenyl ether | 207122-16-5 | 50 µg/mL   | Isooctane | BDE-183S |
| 2,2',3,4,4',6,6'-Heptabromodiphenyl ether |             | 50 µg/mL   | Isooctane | BDE-184S |
| 2,2',3,4,5,5',6-Heptabromodiphenyl ether  |             | 50 µg/mL   | Isooctane | BDE-185S |

Individual PBDEs

# Flame Retardants

Individual PBDEs & Mixtures

Individual PBDEs Standards (in 1 mL of solvent, unless otherwise noted)

| PBDEs  | CAS NO.   | QTY./CONC. | MATRIX    | CAT. NO.      |
|--|-----------|------------|-----------|---------------|
| 2,3,3',4,4',5,6-Heptabromodiphenyl ether       |           | 50 µg/mL   | Isooctane | BDE-190S      |
| 2,3,3',4,4',5',6-Heptabromodiphenyl ether      |           | 50 µg/mL   | Isooctane | BDE-191S      |
| 2,3,3',4,5,5',6-Heptabromodiphenyl ether       |           | 50 µg/mL   | Isooctane | BDE-192S      |
| 2,2',3,3',4,4',5,6'-Octabromodiphenyl ether    |           | 50 µg/mL   | Isooctane | BDE-196S      |
| 2,2',3,3',4,4',6,6'-Octabromodiphenyl ether    |           | 50 µg/mL   | Isooctane | BDE-197S      |
| 2,2',3,3',4,5,5',6'-Octabromodiphenyl ether    |           | 50 µg/mL   | Isooctane | BDE-198S      |
| 2,2',3,4,4',5,5',6'-Octabromodiphenyl ether    |           | 50 µg/mL   | Isooctane | BDE-203S      |
| 2,2',3,4,4',5,6,6'-Octabromodiphenyl ether     |           | 50 µg/mL   | Isooctane | BDE-204S      |
| 2,3,3',4,4',5,5',6'-Octabromodiphenyl ether    |           | 50 µg/mL   | Isooctane | BDE-205S      |
| 2,2',3,3',4,4',5,5',6'-Nonabromodiphenyl ether |           | 50 µg/mL   | Isooctane | BDE-206S      |
| 2,2',3,3',4,4',5,6,6'-Nonabromodiphenyl ether  |           | 10 µg/mL   | Nonane    | BDE-207S-0.2X |
| 2,2',3,3',4,5,5',6,6'-Nonabromodiphenyl ether  |           | 10 µg/mL   | Nonane    | BDE-208S-0.2X |
| Decabromodiphenyl ether                        | 1163-19-5 | 50 µg/mL   | Isooctane | BDE-209S      |

## Polybrominated Diphenyl Ether Mixtures

### Bromodiphenyl Ethers Lake Michigan Study

**BDE-LMS** 1 x 1 mL  
10 µg/mL each in Isooctane 9 comps.

- (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)

### PBDEs in Columbia River

**BDE-CR** 1 x 1 mL  
10 µg/mL each in Isooctane 12 comps.

- (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)

### Common PBDEs in US Environment

**BDE-USE** 1 x 1 mL  
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)

### Common PBDE Congeners in California Environment

**BDE-CAE-1** 1 x 1 mL  
10 µg/mL each in Isooctane 7 comps.

- (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)

### Bromodiphenyl ethers in proposed US EPA Method

**BDE-EPA-SET** 1 x 1 mL  
50 µg/mL each in Isooctane 8 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)
  - 2,2',3,4,4',5',6-Heptabromodiphenyl ether (#183)
  - Decabromodiphenyl ether (#209)

### California Method 750-M Standard

**BDE-CALEWS** 1 x 1 mL  
10 µg/mL each in Isooctane 13 comps.

- (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

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# Flame Retardants

## Method 1614 Polybrominated Diphenyl Ether Mixtures

### Mixture of PBDEs Standard Solution for Accuracy & Precision

At stated conc. in Isooctane

39 comps.

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

### Mixture of Commonly Occurring PBDE Congeners for Precision and Recovery

At stated conc. in Isooctane

14 comps.

| <b>(BZ#)</b>                                    | 1 x 1 mL<br>(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                  |

PBDE Mixtures

## PBDE Congeners of Primary Interest

### Calibration Mix

**BDE-CM** 1 x 1 mL  
At stated conc. in Isooctane 8 comps.

| <b>(BZ#)</b>                                    | (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      |

### PBDE Congeners of Primary Interest

**BDE-CSM** 1 x 1 mL  
At stated conc. in Isooctane 8 comps.

| <b>(BZ#)</b>                                    | (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     |

### Matrix Spiking Solution

**BDE-MS** 1 x 1 mL  
At stated conc. in Isooctane 8 comps.

| <b>(BZ#)</b>                                    | (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      |

# Flame Retardants

## PBDE Metabolites: Hydroxy and Methoxy Polybromo Diphenyl Ether congeners

These metabolites can be found wherever there are PBDEs, and they present their own toxicological hazard. This effect is well known with PCBs where the Hydroxylated species is often more toxic than the parent compounds. AccuStandard's Synthesis Department has prepared the following congeners listed below as a start. We are continuously expanding this list. Please inquire for updates or any specific compound you need. Contact us by phone or e-mail at techservice@accustandard.com

### PBDE Metabolites

PBDE Metabolites (in 1 mL of solvent, unless otherwise noted)

| PBDE METABOLITES                               | CAS NO. | QTY./CONC. | MATRIX | CAT. NO.      |
|--|---------|------------|--------|---------------|
| 3'-Hydroxy-2,4-dibromodiphenyl ether           |         | 50 µg/mL   | AcCN   | HBDE-2001S-CN |
| 4'-Hydroxy-2,2',4-tribromodiphenyl ether       |         | 50 µg/mL   | AcCN   | HBDE-3001S-CN |
| 3'-Hydroxy-2,4,4'-tribromodiphenyl ether       |         | 50 µg/mL   | AcCN   | HBDE-3002S-CN |
| 4-Hydroxy-2,2',3,4'-tetrabromodiphenyl ether   |         | 50 µg/mL   | AcCN   | HBDE-4001S-CN |
| 4'-Hydroxy-2,2',4,5'-tetrabromodiphenyl ether  |         | 50 µg/mL   | AcCN   | HBDE-4002S-CN |
| 3-Hydroxy-2,2',4,4'-tetrabromodiphenyl ether   |         | 50 µg/mL   | AcCN   | HBDE-4003S-CN |
| 5-Hydroxy-2,2',4,4'-tetrabromodiphenyl ether   |         | 50 µg/mL   | AcCN   | HBDE-4004S-CN |
| 4-Hydroxy-2,2',3,4',5-pentabromodiphenyl ether |         | 50 µg/mL   | AcCN   | HBDE-5001S-CN |
| 3'-Methoxy-2,4-dibromodiphenyl ether           |         | 50 µg/mL   | MeOH   | MOBDE-2001S   |
| 4'-Methoxy-2,2',4-tribromodiphenyl ether       |         | 50 µg/mL   | MeOH   | MOBDE-3001S   |
| 3'-Methoxy-2,4,4'-tribromodiphenyl ether       |         | 50 µg/mL   | MeOH   | MOBDE-3002S   |
| 2'-Methoxy-2,4,4'-tribromodiphenyl ether       |         | 50 µg/mL   | MeOH   | MOBDE-3003S   |
| 4-Methoxy-2,2',3,4'-tetrabromodiphenyl ether   |         | 50 µg/mL   | MeOH   | MOBDE-4001S   |
| 4'-Methoxy-2,2',4,5'-tetrabromodiphenyl ether  |         | 50 µg/mL   | MeOH   | MOBDE-4002S   |
| 3-Methoxy-2,2',4,4'-tetrabromodiphenyl ether   |         | 50 µg/mL   | MeOH   | MOBDE-4003S   |
| 5-Methoxy-2,2',4,4'-tetrabromodiphenyl ether   |         | 50 µg/mL   | MeOH   | MOBDE-4004S   |
| 4-Methoxy-2,2',3,4',5-pentabromodiphenyl ether |         | 50 µg/mL   | MeOH   | MOBDE-5001S   |

### Bromobiphenyl Congeners

Individual Bromobiphenyl Congeners (in 1 mL of solvent, unless otherwise noted)

| BROMOBIPHENYL CONGENERS          | CAS NO.    | QTY./CONC. | MATRIX    | CAT. NO.    |
|----------------------------------|------------|------------|-----------|-------------|
| 2-Bromobiphenyl                  | 2052-07-5  | 50 mg      | Neat      | B-001N      |
|                                  |            | 35 µg/mL   | Isooctane | B-001S      |
|                                  |            | 1 mg/mL    | Acetone   | M-8081-SS-X |
| 3-Bromobiphenyl                  | 2113-57-7  | 50 mg      | Neat      | B-002N      |
|                                  |            | 35 µg/mL   | Isooctane | B-002S      |
| 4-Bromobiphenyl                  | 92-66-0    | 50 mg      | Neat      | B-003N      |
|                                  |            | 35 µg/mL   | Isooctane | B-003S      |
| 2,2'-Dibromobiphenyl             | 13099-09-9 | 10 mg      | Neat      | B-004N      |
|                                  |            | 35 µg/mL   | Isooctane | B-004S      |
| 2,4-Dibromobiphenyl              | 53592-10-2 | 25 mg      | Neat      | B-007N      |
|                                  |            | 35 µg/mL   | Isooctane | B-007S      |
| 2,5-Dibromobiphenyl              | 57422-77-2 | 25 mg      | Neat      | B-009N      |
|                                  |            | 35 µg/mL   | Isooctane | B-009S      |
| 2,6-Dibromobiphenyl              | 59080-32-9 | 10 mg      | Neat      | B-010N      |
|                                  |            | 35 µg/mL   | Isooctane | B-010S      |
| 4,4'-Dibromobiphenyl             | 92-86-4    | 10 mg      | Neat      | B-015N      |
|                                  |            | 35 µg/mL   | Isooctane | B-015S      |
| 2,2',4,4',5,5'-Hexabromobiphenyl | 59080-40-9 | 10 mg      | Neat      | B-153N      |
|                                  |            | 35 µg/mL   | Isooctane | B-153S      |
| 2,2',4,4',6,6'-Hexabromobiphenyl | 59261-08-4 | 5 mg       | Neat      | B-155N      |
|                                  |            | 35 µg/mL   | Isooctane | B-155S      |
| 3,3',4,4',5,5'-Hexabromobiphenyl | 77607-09-1 | 35 µg/mL   | Isooctane | B-169S      |
| 2,2',4,5,5'-Pentabromobiphenyl   | 67888-96-4 | 35 µg/mL   | Isooctane | B-101S      |
| 2,2',4,5'-Tetrabromobiphenyl     | 60044-24-8 | 10 mg      | Neat      | B-049N      |
|                                  |            | 35 µg/mL   | Isooctane | B-049S      |
| 2,2',5,5'-Tetrabromobiphenyl     | 59080-37-4 | 10 mg      | Neat      | B-052N      |
|                                  |            | 35 µg/mL   | Isooctane | B-052S      |
| 2,2',5,6'-Tetrabromobiphenyl     | 60044-25-9 | 10 mg      | Neat      | B-053N      |
|                                  |            | 35 µg/mL   | Isooctane | B-053S      |
| 3,3',4,4'-Tetrabromobiphenyl     | 77102-82-0 | 35 µg/mL   | Isooctane | B-077S      |
| 3,3',5,5'-Tetrabromobiphenyl     | 16400-50-3 | 35 µg/mL   | Isooctane | B-080S      |
| 2,2',5-Tribromobiphenyl          | 59080-34-1 | 10 mg      | Neat      | B-018N      |
|                                  |            | 35 µg/mL   | Isooctane | B-018S      |
| 2,3',5-Tribromobiphenyl          | 59080-35-2 | 10 mg      | Neat      | B-026N      |
|                                  |            | 35 µg/mL   | Isooctane | B-026S      |
| 2,4,6-Tribromobiphenyl           | 59080-33-0 | 25 mg      | Neat      | B-030N      |
|                                  |            | 35 µg/mL   | Isooctane | B-030S      |
| 2,4',5-Tribromobiphenyl          | 59080-35-3 | 10 mg      | Neat      | B-031N      |
|                                  |            | 35 µg/mL   | Isooctane | B-031S      |

# Flame Retardants

## Other Flame Retardants

Individual Flame Retardants (in 1 mL of solvent, unless otherwise noted)

| FLAME RETARDANTS               | CAS NO.    | QTY./CONC. | MATRIX    | CAT. NO.     |
|--------------------------------|------------|------------|-----------|--------------|
| 4-Bromophenyl phenyl ether     | 101-55-3   | 100 µg/mL  | MeOH      | APP-9-033    |
|                                |            | 5 mg/mL    | MeOH      | AS-E0039     |
| Chlorafin™ 40                  | 63449-39-8 | 10 mg      | Neat      | FRS-002N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-002S     |
| Chlorendic anhydride           | 115-27-5   | 10 mg      | Neat      | FRS-001N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-001S     |
| bis(2-Chloroethyl)ether        | 111-44-4   | 100 µg/mL  | MeOH      | APP-9-027    |
|                                |            | 5 mg/mL    | MeOH      | AS-E0016     |
| 4-Chlorophenyl phenyl ether    | 7005-72-3  | 100 µg/mL  | MeOH      | APP-9-047    |
|                                |            | 5 mg/mL    | MeOH      | AS-E0038     |
| Chlorowax™ 500C                | 63449-39-8 | 10 mg      | Neat      | FRS-004N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-004S     |
| Diable 700X                    |            | 10 mg      | Neat      | FRS-005N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-005S     |
| Dow FR-250 (Octabromobiphenyl) | 27858-07-7 | 10 mg      | Neat      | B-250N       |
|                                |            | 100 µg/mL  | Isooctane | B-250S       |
|                                |            | 35 µg/mL   | Isooctane | B-250S-0.35X |
| Firemaster™ BP4A               | 79-94-7    | 10 mg      | Neat      | FRS-006N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-006S     |
| Firemaster BP-6                | 59536-65-1 | 10 mg      | Neat      | B-600N       |
|                                |            | 35 µg/mL   | Isooctane | B-600S-0.35X |
|                                |            | 100 µg/mL  | Isooctane | B-600S       |
| Firemaster PHT4                | 632-79-1   | 10 mg      | Neat      | FRS-007N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-007S     |
| Firemaster T23P                |            | 10 mg      | Neat      | FRS-008N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-008S     |
| FR-300BA                       | 1163-19-5  | 10 mg      | Neat      | FRS-009N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-009S     |
| FR-651A                        | 87-84-3    | 10 mg      | Neat      | FRS-010N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-010S     |
| FR-1138                        | 3296-90-0  | 10 mg      | Neat      | FRS-011N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-011S     |
| Hexabromobenzene (mich)        | 87-82-1    | 10 mg      | Neat      | FRS-012N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-012S     |
| Hexabromobenzene (white)       | 87-82-1    | 10 mg      | Neat      | FRS-013N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-013S     |
| Hexachlorobutadiene            | 87-68-3    | 10 mg      | Neat      | FRS-017N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-017S     |
| Paroil™ 179-HV                 | 63449-39-8 | 10 mg      | Neat      | FRS-015N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-015S     |
| Paroil 170-8                   | 63449-39-8 | 10 mg      | Neat      | FRS-016N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-016S     |
| Pentabromotoluene              | 87-83-2    | 10 mg      | Neat      | FRS-018N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-018S     |
| Phosgard™ C 22-R               | 4351-70-6  | 10 mg      | Neat      | FRS-019N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-019S     |
| Phosgard 2XC-20                |            | 10 mg      | Neat      | FRS-020N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-020S     |
| Tetrabromo-o-chlorotoluene     |            | 10 mg      | Neat      | FRS-021N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-021S     |
| Tetrachlorobisphenol A         | 79-95-8    | 10 mg      | Neat      | FRS-022N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-022S     |
| TP-69                          |            | 10 mg      | Neat      | FRS-023N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-023S     |
| Unichlor™ 40-90                | 63449-39-8 | 10 mg      | Neat      | FRS-024N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-024S     |
| Unichlor 502-50                | 63449-39-8 | 10 mg      | Neat      | FRS-025N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-025S     |
| Unichlor 70AX                  | 63449-39-8 | 10 mg      | Neat      | FRS-026N     |
|                                |            | 100 µg/mL  | Toluene   | FRS-026S     |

### Registered Trademarks

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

|                  |                 |             |                  |                  |
|------------------|-----------------|-------------|------------------|------------------|
| 101-55-3:24, 29  | B-030N:28       | BDE-060S:24 | BDE-167S:25      | FRS-022N:29      |
| 111-44-4:29      | B-030S:28       | BDE-061S:24 | BDE-168S:25      | FRS-022S:29      |
| 115-27-5:29      | B-031N:28       | BDE-062S:24 | BDE-172S:25      | FRS-023N:29      |
| 1163-19-5:26, 29 | B-031S:28       | BDE-063S:24 | BDE-173S:25      | FRS-023S:29      |
| 13099-09-9:28    | B-049N:28       | BDE-066S:25 | BDE-175S:25      | FRS-024N:29      |
| 147217-78-5:24   | B-049S:28       | BDE-067S:25 | BDE-180S:25      | FRS-024S:29      |
| 16400-50-3:28    | B-052N:28       | BDE-068S:25 | BDE-181S:25      | FRS-025N:29      |
| 182346-21-0:25   | B-052S:28       | BDE-069S:25 | BDE-182S:25      | FRS-025S:29      |
| 182677-30-1:25   | B-053N:28       | BDE-071S:25 | BDE-183S:25      | FRS-026N:29      |
| 189084-61-5:25   | B-053S:28       | BDE-072S:25 | BDE-184S:25      | FRS-026S:29      |
| 189084-64-8:25   | B-077S:28       | BDE-073S:25 | BDE-185S:26      | HBDE-2001S-CN:28 |
| 2050-47-7:24     | B-080S:28       | BDE-074S:25 | BDE-190S:26      | HBDE-3001S-CN:28 |
| 2052-07-5:28     | B-153N:28       | BDE-075S:25 | BDE-191S:26      | HBDE-3002S-CN:28 |
| 207122-15-4:25   | B-153S:28       | BDE-076S:25 | BDE-192S:26      | HBDE-4001S-CN:28 |
| 207122-16-5:25   | B-155N:28       | BDE-077S:25 | BDE-196S:26      | HBDE-4002S-CN:28 |
| 2113-57-7:28     | B-155S:28       | BDE-078S:25 | BDE-197S:26      | HBDE-4003S-CN:28 |
| 27858-07-7:29    | B-169S:28       | BDE-079S:25 | BDE-198S:26      | HBDE-4004S-CN:28 |
| 3296-90-0:29     | B-250N:29       | BDE-080S:25 | BDE-203S:26      | HBDE-5001S-CN:28 |
| 41318-75-6:24    | B-250S:29       | BDE-081S:25 | BDE-204S:26      | M-8081-SS-X:28   |
| 4351-70-6:29     | B-250S-0.35X:29 | BDE-085S:25 | BDE-205S:26      | MOBDE-2001S:28   |
| 53592-10-2:28    | B-600N:29       | BDE-086S:25 | BDE-206S:26      | MOBDE-3001S:28   |
| 5436-43-1:24     | B-600S:29       | BDE-087S:25 | BDE-207S-0.2X:26 | MOBDE-3002S:28   |
| 57422-77-2:28    | B-600S-0.35X:29 | BDE-088S:25 | BDE-208S:26      | MOBDE-4001S:28   |
| 59080-32-9:28    | BDE-001S:24     | BDE-092S:25 | BDE-209S:26      | MOBDE-4002S:28   |
| 59080-33-0:28    | BDE-002S:24     | BDE-092S:25 | BDE-AAP-A:27     | MOBDE-4003S:28   |
| 59080-34-1:28    | BDE-003S:24     | BDE-094S:25 | BDE-AAP-A15X:27  | MOBDE-4004S:28   |
| 59080-35-2:28    | BDE-004S:24     | BDE-097S:25 | BDE-CAE-1:26     | MOBDE-5001S:28   |
| 59080-35-3:28    | BDE-005S:24     | BDE-098S:25 | BDE-CALEWS:26    |                  |
| 59080-37-4:28    | BDE-006S:24     | BDE-099S:25 | BDE-CM:27        |                  |
| 59080-40-9:28    | BDE-007S:24     | BDE-100S:25 | BDE-COC:27       |                  |
| 59261-08-4:28    | BDE-008S:24     | BDE-101S:25 | BDE-CR:26        |                  |
| 59536-65-1:29    | BDE-009S:24     | BDE-102S:25 | BDE-CS-SET:27    |                  |
| 60044-24-8:28    | BDE-010S:24     | BDE-103S:25 | BDE-CSM:27       |                  |
| 60044-25-9:28    | BDE-011S:24     | BDE-104S:25 | BDE-EPA-SET:26   |                  |
| 60348-60-9:25    | BDE-012S:24     | BDE-105S:25 | BDE-LMS:26       |                  |
| 632-79-1:29      | BDE-013S:24     | BDE-106S:25 | BDE-MS:27        |                  |
| 63449-39-8:29    | BDE-014S:24     | BDE-108S:25 | BDE-USE:26       |                  |
| 68631-49-2:25    | BDE-015S:24     | BDE-109S:25 | FRS-001N:29      |                  |
| 7005-72-3:29     | BDE-016S:24     | BDE-111S:25 | FRS-001S:29      |                  |
| 77102-82-0:28    | BDE-017S:24     | BDE-114S:25 | FRS-002N:29      |                  |
| 77607-09-1:28    | BDE-018S:24     | BDE-115S:25 | FRS-002S:29      |                  |
| 79-94-7:29       | BDE-019S:24     | BDE-116S:25 | FRS-004N:29      |                  |
| 79-95-8:29       | BDE-020S:24     | BDE-118S:25 | FRS-004S:29      |                  |
| 87-68-3:29       | BDE-021S:24     | BDE-119S:25 | FRS-005N:29      |                  |
| 87-82-1:29       | BDE-022S:24     | BDE-120S:25 | FRS-005S:29      |                  |
| 87-83-2:29       | BDE-023S:24     | BDE-121S:25 | FRS-006N:29      |                  |
| 87-84-3:29       | BDE-025S:24     | BDE-123S:25 | FRS-006S:29      |                  |
| 92-66-0:28       | BDE-026S:24     | BDE-124S:25 | FRS-007N:29      |                  |
| 92-86-4:28       | BDE-027S:24     | BDE-125S:25 | FRS-007S:29      |                  |
| APP-9-027:29     | BDE-028S:24     | BDE-126S:25 | FRS-008N:29      |                  |
| APP-9-033:29     | BDE-029S:24     | BDE-127S:25 | FRS-008S:29      |                  |
| APP-9-047:29     | BDE-030S:24     | BDE-128S:25 | FRS-009N:29      |                  |
| AS-E0016:29      | BDE-031S:24     | BDE-130S:25 | FRS-009S:29      |                  |
| AS-E0038:29      | BDE-032S:24     | BDE-131S:25 | FRS-010N:29      |                  |
| AS-E0039:29      | BDE-033S:24     | BDE-136S:25 | FRS-010S:29      |                  |
| B-001N:28        | BDE-034S:24     | BDE-137S:25 | FRS-011N:29      |                  |
| B-001S:28        | BDE-035S:24     | BDE-138S:25 | FRS-011S:29      |                  |
| B-002N:28        | BDE-036S:24     | BDE-139S:25 | FRS-012N:29      |                  |
| B-002S:28        | BDE-037S:24     | BDE-140S:25 | FRS-012S:29      |                  |
| B-003N:28        | BDE-038S:24     | BDE-141S:25 | FRS-013N:29      |                  |
| B-003S:28        | BDE-039S:24     | BDE-142S:25 | FRS-013S:29      |                  |
| B-004N:28        | BDE-040S:24     | BDE-144S:25 | FRS-015N:29      |                  |
| B-004S:28        | BDE-041S:24     | BDE-146S:25 | FRS-015S:29      |                  |
| B-007N:28        | BDE-042S:24     | BDE-148S:25 | FRS-016N:29      |                  |
| B-007S:28        | BDE-043S:24     | BDE-153S:25 | FRS-016S:29      |                  |
| B-009N:28        | BDE-046S:24     | BDE-154S:25 | FRS-017N:29      |                  |
| B-009S:28        | BDE-047S:24     | BDE-155S:25 | FRS-017S:29      |                  |
| B-010N:28        | BDE-048S:24     | BDE-156S:25 | FRS-018N:29      |                  |
| B-010S:28        | BDE-049S:24     | BDE-157S:25 | FRS-018S:29      |                  |
| B-015N:28        | BDE-050S:24     | BDE-158S:25 | FRS-019N:29      |                  |
| B-015S:28        | BDE-051S:24     | BDE-159S:25 | FRS-019S:29      |                  |
| B-018N:28        | BDE-053S:24     | BDE-160S:25 | FRS-020N:29      |                  |
| B-018S:28        | BDE-055S:24     | BDE-161S:25 | FRS-020S:29      |                  |
| B-026N:28        | BDE-057S:24     | BDE-162S:25 | FRS-021N:29      |                  |
| B-026S:28        | BDE-058S:24     | BDE-166S:25 | FRS-021S:29      |                  |