

**Order The New  
1998 Edition Of The  
Proposition 65  
Handbook**

**Prop 65 News  
September 1994, Vol 8, No. 9**



- Search Prop 65 News
- Search the Prop 65 Litigation Reporter
- Conference 2000
- Subscribe Online
- Contact Prop 65 News
- Home

**Chemical of the Month  
Carcinogen Profile: Polybrominated Biphenyls (PBBs)**

By Sharan Campleman, M.S., M.P.H  
U.C. Berkeley, School of Public Health

Polybrominated biphenyls (PBBs) are a class of man-made aromatics consisting of two benzene rings and two or more substituent bromine atoms. No natural occurring source exists in the environment. And, of the 42 PBB congeners synthesized, only four commercial PBB products were produced: FireMaster BP-6, FireMaster FF-1, Bromkal 80, and Flammex B. All of these commercial products contained a mixture of several individual PBBs. The major commercial application of these inert solids was as a flame retardant, usually within various plastic parts for electrical products, such as radios and televisions, and for business machine or motor housings. However, commercial production ceased in 1977. Currently, the most likely sources of exposure are waste sites containing PBB contaminated manufacturing debris or soil.

The downfall of PBBs began in 1973 after the poisoning of Michigan farm livestock by PBB-contaminated animal feed. A PBB-containing commercial product, FireMaster FF-1, was mistaken as the feed supplement magnesium oxide. Initially, health problems in dairy cattle indicated a poisoning, but several months passed before PBBs were identified as the problem. Following the establishment of a Michigan Department of Agriculture (MDA) farm animal testing and quarantining program, over 30,000 cattle, 2,000 swine, 400 sheep and 2,000,000 chickens exceeding PBB tolerances were destroyed (MDA meat fat 0.02 ppm, FDA milk 1 ppm, FDA 0.1 ppm eggs). During the nine months between the initial accident, detection, PBB identification, animal testing, and quarantines, PBB contaminated food products were consumed by producers and consumers. Epidemiological studies targeting the exposed population continue in order to evaluate long-term risks.

**Material Identification**

Material Name:	The four most abundant PBB congeners are hexabromobiphenyl, octabromobiphenyl, decabromobiphenyl, 2,2'4,4',5,5'-hexabromobiphenyl. Commercially available PBB formulations were mixtures of PBBs and non-PBB impurities. For example, one analyzed lot of FireMaster BP-6 contained 22 different PBBs.
Trade Names:	FireMaster BP-6, FireMaster FF-1, Bromkal 80 and Flammex B 10 (or Adine 0102 or Berkflam B 10)
Chemical Names/Molecular Formula/Trade Names:	hexabromobiphenyl C <sub>12</sub> H <sub>4</sub> Br <sub>6</sub> CAS 59536-65-1 (BP-6) NIOSH RTECS LK 5060000 CAS 67774-32-7 (FF-1) NIOSH RTECS LK 5065000 CAS 36355-01-8 (hexabromo mix)

<p>octabromobiphenyl C<sub>12</sub>H<sub>2</sub>Br<sub>8</sub>  CAS 27858-07-7 (octobromo mix)  NIOSH RTECS DV 570000 CAS  61288-13-9 (Bromkal 80)  decabromobiphenyl C<sub>12</sub>Br<sub>10</sub>  CAS 13654-09-6 (pure and tech)  2,2',4,4',5,5'-hexabromobiphenyl  C<sub>12</sub>H<sub>4</sub>Br<sub>6</sub> CAS 59080-40-9</p>
-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

### Exposure Limits:

**IARC** — Group 2B carcinogenic classification (Firemaster FF-1)

**NTP Carcinogenesis Studies** — clear evidence (Firemaster FF-1)  
NTP-TR-244,83.

**EPA OTS** — Toxic Chemical Release Reporting: Community Right to Know  
List

No regulations for PBBs in Clean Water Effluent Guidelines or for PBBs in  
food (FDA and Michigan Department of Agriculture levels are no longer in  
effect).

### Health Hazard Information

Summary: Inhalation and dermal absorption are the most likely routes of  
human exposure to PBB mixtures in occupational settings. And, as  
demonstrated by the Michigan episode, the general population may be  
exposed to PBBs orally (food-chain transfer). The majority of human PBB  
toxicity data comes from Michigan population studies where the PBB isomers  
consumed appear to have been penta-, hexa-, and heptabromobiphenyls.  
The variety of symptoms reported include neurological, neuropsychiatric,  
gastrointestinal, hepatic, dermal, immunological and musculoskeletal  
complaints; but, no correlation between PBB exposure and prevalence of  
symptoms has been found to date. Neuro-developmental effects in children  
have been reported. Numerous studies found PBBs in the breast milk of  
Michigan women, ranging from 0 to 92.7 mg/kg (median 0.25 mg/kg) in one  
report, indicating lactation as an important exposure route for infants.

Animal data (majority oral exposure): Generally acute LD<sub>50</sub> doses are high,  
but subchronic poisoning results in loss of bodyweight, liver hypertrophy, skin  
lesions/acne, immuno-suppression, neuromuscular effects, thyroid,  
hematologic, teratogenic and embryotoxic effects. Several species (rats, mice,  
monkeys) have reported fetotoxic and developmental effects, including  
embryolethality, growth retardation, fetal malformations, and performance  
deficits, in oral acute-, subchronic-, and chronic-duration studies utilizing  
commercial mixtures of PBBs (FF-1 and BP-6). These commercial  
hexabromobiphenyl mixtures (FF-1) also appear hepatocarcinogenic in  
rodents.

### Physical Data

Molecular weight:	627.4 (hexamers), 785.2 (octamers), 943.1 (decamers)
Color:	White
Physical State:	Solid
Melting Point:	72°C (162°F) (hexamer); 367°C (693°F) (industrial octamer); 380-386°C (716-727°F) (decamer)
Vapor Pressure:	5.2x10 <sup>-8</sup> mmHg @ 25°C (77°F) (hexamer); 7x10 <sup>-11</sup> mmHg @ 28°C (82°F) (octamer)
Solubility in Water:	11 ug/L (hexamer); 20-30 ug/L (octamers); decamer insoluble in water

Solubility in Organics:

Hexamer - acetone, benzene  
Octamer - methylene chloride,  
benzene Decamer - chlorobenzene,  
o-xylene (moderate) Decompose  
with heat to extremely toxic fumes  
of Br-.

### References

- Sources: ATSDR. 1993. Toxicological Profile for Polybrominated Biphenyls (PBBs), Draft for Public Comment, U.S. Dept of Health & Human Services, Public Health Service.
- Carcinogenically Active Chemicals. 1991. R.J.Lewis, Ed., Van Nostrand Reinhold, New York, pp.273,603. IARC. 1986.
- IARC monographs on the evaluation of the carcinogenic risk of chemicals to humans. Vol.41: Some halogenated hydrocarbons and pesticide exposures. World Health Organization, Lyon, France, pp. 261-292.
- Reproductively Active Chemicals. 1991. R.J. Lewis, Ed., Van Nostrand Reinhold, New York, pp.274-75.

Sharan Campleman is a Ph.D. candidate in Environmental Health Sciences and Toxicology at U.C. Berkeley.

[RETURN TO TABLE OF CONTENTS](#)

---

| [Events](#) | [How to Order](#) | [Contact Us](#) | [Prop 65 News](#) | [Litigation Reporter](#) |  
[Home Page](#) |

Copyright © 1996 [Prop 65 News](#). All Rights Reserved.