



**U.S. Environmental Protection Agency**



**U.S. Maritime Administration**

This document is one section from the “National Guidance: Best Management Practices for Preparing Vessels Intended to Create Artificial Reefs,” published in May 2006. The reference number is EPA 842-B-06-002. You can find the entire document at <http://www.epa.gov/owow/oceans/habitat/artificialreefs/index.html>.

# **National Guidance: Best Management Practices for Preparing Vessels Intended to Create Artificial Reefs**

## **Polychlorinated Biphenyls (PCBs)**

May 2006

## **POLYCHLORINATED BIPHENYLS (PCBs)**

***Narrative Clean-up Goal:*** Remove all manufactured products containing greater than or equal to ( $\geq$ ) 50 parts per million (ppm) of solid PCBs; remove all liquid PCBs regardless of concentration; remove all materials contaminated by PCB spills where the concentration of the original PCB source is  $\geq$  50 ppm.

### ***What are PCBs?***

PCBs belong to a broad family of man-made organic chemicals known as chlorinated hydrocarbons. PCBs, which were domestically manufactured from 1929 until their manufacture was banned in 1979, have a range of toxicity and vary in consistency from thin, light-colored liquids to yellow or black waxy solids. Due to their non-flammability, chemical stability, high boiling point, and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including electrical, heat transfer, and hydraulic equipment; as plasticizers in paints, plastics, and rubber products; in pigments, dyes, and carbonless copy paper; and many other industrial applications.

### ***What are the potential environmental impacts of PCBs?***

PCBs have been demonstrated to cause a variety of adverse health effects. PCBs have been shown to cause cancer in animals and have also been shown to cause a number of serious non-cancer health effects in animals, including effects on the immune system, reproductive system, nervous system, endocrine system, and other health effects. Studies in humans provide supportive evidence for potential carcinogenic and non-carcinogenic effects of PCBs. The different health effects of PCBs may be interrelated, as alterations in one system may have significant implications for the other systems of the body. EPA's peer reviewed cancer reassessment concluded that PCBs are probable human carcinogens. In addition, PCBs are persistent and bioaccumulative. PCBs bioaccumulate in fatty or lipid-rich tissues. PCBs have a limited solubility in aqueous solutions and PCBs can leach into a marine or aqueous environment (sediment and water column) where they can be taken up by organisms in the food web. PCBs bioaccumulate in fish and other animals; PCBs also bind to sediments. As a result, people who ingest fish may be exposed to PCBs that have been released into the environment and bioaccumulated in the fish they are ingesting.

There is a risk of human exposure during vessel preparation and after sinking the vessel. During vessel preparation, typical routes of human exposure include inhalation, accidental ingestion, or dermal contact. After sinking, exposure routes may be limited to accidental ingestion or contact with contaminated water and sediments, or ingestion of contaminated fish, shellfish, or crustaceans. (See Appendix C)

### *Where are PCBs found on a ship?*

Although no longer commercially produced in the United States, PCBs are most likely to be present in vessels deployed before the 1979 PCB ban. For such vessels, PCBs may be found in both the solid (waxy) and liquid (oily) forms in equipment and materials onboard ships. The equipment that may contain PCBs in concentrations of  $\geq 50$  ppm and the manufactured products containing  $\geq 50$  ppm of solid PCBs, include:

#### *Materials and items that could contain solid PCBs*

- Cable insulation
- Rubber and felt gaskets
- Thermal insulation material including fiberglass, felt, foam, and cork
- Voltage regulators, switches, reclosers, bushings, and electromagnets
- Electronic equipment, switchboards, and consoles
- Adhesives and tapes
- Oil-based paint
- Caulking
- Rubber isolation mounts
- Foundation mounts
- Pipe hangers
- Plastics

#### *Materials and items that could contain liquid PCBs*

- Oil used in electrical equipment and motors, anchor windlasses, hydraulic systems, and leaks and spills from such items

#### *Materials and items that could contain either liquid or solid PCBs*

- Transformers, capacitors, and electronic equipment with capacitors and transformers inside
- Fluorescent light ballasts
- Surface contamination of machinery and other solid surfaces

Items containing PCBs may be found throughout a ship and are not always easily identifiable or readily accessible. PCBs may be found in a variety of shipboard materials, but the location and concentration can vary from item to item and within classes of items. PCB-containing materials also are likely to vary from ship to ship, and even ships in the same class can contain differing types and amounts of PCB-containing materials. While these materials may be found throughout a ship, several areas on ships may have an increased likelihood of containing PCB-bearing materials: areas or rooms subject to high heat or fire situations such as boiler rooms, engine rooms, electrical/radio rooms, weapons storage areas, or areas with hydraulic equipment. Be aware that these pieces of equipment or systems are vulnerable to leaks and spills, which could leave spill residues behind and contaminate porous materials (e.g., carpet, wood, rubber/plastic mats, paint).



Photo courtesy of Laura S. Johnson

Ex-USS Oriskany electronic equipment stripped of capacitors and transformers.

***How should the vessel be prepared; what are the appropriate BMPs for PCBs?***

PCBs are regulated for disposal under 40 CFR Part 761, and will be discussed in this context. The PCB regulations require manufactured products containing  $\geq 50$  ppm of solid PCBs (PCB bulk product waste) and materials contaminated by spills of liquids containing PCBs (PCB remediation waste) to be properly disposed. Although the ship itself is being “reused” or “recycled” as an artificial reef, the PCBs must be properly disposed. Disposal requirements for each type of PCB waste are referenced below (also see Appendix B).

Where there is reason to suspect that equipment or manufactured products containing solid PCBs may contain PCBs  $\geq 50$  ppm, either remove the equipment or component from the vessel, or provide proof that the equipment or component is free of PCBs, unless a PCB bulk product waste disposal approval has been obtained under 40 CFR 761.62(c) (see below).

Under TSCA regulations, a spill of liquids containing PCBs  $\geq 50$  ppm is considered an illegal disposal of PCBs. Material(s) contaminated by such a spill must be cleaned or removed and disposed of, unless a risk-based disposal approval has been obtained under 40 CFR 761.61(c). Spill residues and materials contaminated by these spills are regulated differently than bulk product waste (see below).

The design and implementation of a representative sampling and analytical plan can help determine the presence or absence of PCBs in materials containing solid PCBs at  $\geq 50$  ppm or materials containing PCBs as the result of spills. If the data from the sampling and analytical

plan indicates the absence of PCBs, the ship and its components are not subject to the PCB provisions of TSCA.

### **Liquid Materials Manufactured with PCBs**

Remove all liquid-filled electrical equipment suspected of containing PCBs or PCB-contaminated dielectric fluid, regardless of PCB concentration. Materials such as lubricating oils and greases used for winches and cargo-handling machinery, hydraulic fluids, heat transfer fluids, and waste oils should be removed from the vessel in accordance with the guidance in the “Oil and Fuel” section of this document.



Photo courtesy of Laura Casey

Engine room electrical cabling on the ex-USS Oriskany.

### **Manufactured Products Containing Solid PCBs**

Remove all manufactured products containing  $\geq 50$  ppm of solid PCBs, which includes, but is not limited to, felt gasket and faying material, cables, paints, rubber gaskets, as well as battle lanterns and fluorescent light ballasts.

Thermally removing PCB-containing materials is generally not authorized without prior written approval. Because PCB sampling and analytical procedures can be expensive and time consuming, there may be situations when the cost of sampling and analysis far exceeds the cost for removal and disposal. In some cases, vessel-to-reef projects have shown that removal of all electrical cables and wires suspected of containing PCBs was the most economical course of action.

While the complete removal of all manufactured products containing  $\geq 50$  ppm of solid PCBs is recommended, EPA recognizes that in some vessels it may not be feasible to identify and remove every such item. If such materials cannot be feasibly identified and/or removed, an application to EPA for a risk-based approval to dispose of the PCB bulk product waste in a marine environment for purposes of creating an artificial reef is required pursuant to 40 CFR 761.62(c). (EPA's decision includes consideration of a risk assessment submitted by the applicant, and a public participation process. Please consult the responsible EPA office for more information.)<sup>3</sup>

### **Materials Containing PCBs as a Result of Spills**

Remove all materials containing  $\geq 50$  ppm of PCBs due to PCB spills. In addition, depending on the concentration of the spilled PCBs and the date when the spill occurred, it may be necessary to remove materials currently containing less than 50 ppm of PCBs due to spills.<sup>4</sup> If it is not known when a spill occurred, you should generally assume that it occurred after July 1, 1979.

During vessel clean-up/preparation, attention should be directed to locations on the ship that are known to house equipment and systems that typically contain PCB liquids. Because such equipment or systems are vulnerable to leaks and spills during the lifetime of the vessel, the areas surrounding the equipment or systems are likely contaminated by liquids containing PCBs.

If there is no information regarding whether a spill occurred and/or the PCB concentration of any spilled liquid, design and implement a representative sampling plan to verify that there are no PCBs present in the areas surrounding the liquid-filled equipment or systems. If the sampling results indicate presence of PCBs as a result of a spill of liquids containing PCBs, remove the spill residue and the materials contaminated by the spill (e.g., remove paint from a contaminated surface such as a metal deck, strip the contaminated area down to bare metal in accordance with 40 CFR 761.79(b)(i)(B)). If spill residues or materials contaminated by PCB spills cannot be feasibly removed, an application to EPA for a risk-based approval to dispose of the PCBs in a marine environment for purposes of creating an artificial reef is required pursuant to 40 CFR 761.61(c). (EPA's decision includes consideration of a risk assessment submitted by the applicant, and a public participation process. Please consult the responsible EPA office for more information (see footnote # 3).)

---

<sup>3</sup> Any vessel owner and/or sponsor should carefully consider the amount of time, resources and financial commitments necessary to address the identification, removal, and disposal of non-liquid PCB-containing materials and materials contaminated by spills of liquids containing PCBs before finally deciding if a vessel is suitable for reefing, and well in advance of commencing clean-up. EPA strongly recommends vessel owners and/or sponsors to begin discussions as soon as possible with the PCB coordinator for the EPA Region in which the vessel is proposed to be sunk. A list of EPA's current PCB coordinators may be found at [www.epa.gov/pcb/coordin.html](http://www.epa.gov/pcb/coordin.html).

<sup>4</sup> For PCB spills that occurred between April 18, 1978, and July 1, 1979, and where the original source was  $\geq 500$  ppm PCBs, remove all materials containing any concentration of PCBs. For PCB spills that occurred after July 1, 1979, and where the original source was  $\geq 50$  ppm PCBs, remove all materials containing any concentration of PCBs. Remove all materials currently containing  $\geq 50$  ppm PCBs as a result of spills (of any concentration) that occurred prior to April 18, 1978. Consult the PCB regulations at 40 CFR 761.3, 761.50(b)(3) and 761.61.