dpSTUDIO
environmental consulting & design

Issue No. 4 | December 2016 **Is It a REC? – The ABCs of PCBs**

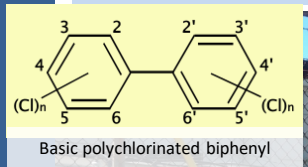
In the previous Issue of our continuing series on some less well-defined site conditions that might be considered *recognized environmental conditions (REC)* for a Phase I Environmental Site Assessment (ESA), we considered hydraulic fluids that may contain polychlorinated biphenyls (PCBs). The potential for PCBs and PCB-containing equipment to be a REC is specifically called out in the American Society for Testing and Materials (ASTM International) E1527-13 "Standard Practice for Environmental Site Assessments." But just what are these seemingly ubiquitous chemicals, and why do environmental professionals need to carefully address them in an ESA?

Background and Need for Regulation

PCB oil has been used as a heat transfer media and in other industrial applications from approximately 1929 until 1979, when the U.S. banned PCB manufacturing and phased out most uses under the early days of TSCA, or Toxic Substances Control Act (US Environmental Protection Agency, 1979). Certain uses of PCBs are still authorized under TSCA, for example in transformers if PCB levels remain under 50 parts per million (ppm) or with restriction and regulatory requirements at higher concentrations. Lower allowable concentrations apply to manufacturing processes that may generate PCBs as a consequence of processes that involve hydrocarbons, chlorine, and heat.

Because PCBs have a high chemical and thermal stability, they can persist in the environment for decades. Their low solubility allows PCBs to bind strongly to soils and sediment and travel via surface water and groundwater. They also can become airborne. Once in the aquatic environment, PCBs are further transported by bio uptake from small organisms, and accumulate in the fatty tissues of higher organisms up the food chain, all the way to humans. PCBs that have been involved in combustion or high temperatures can form dioxins and furans, another class of toxic and persistent compounds. Whether by physical or biological transport, the extreme stability of PCBs allows them to be "re-emitted" and transported great distances for continued exposure. As further evidence of their persistence and distribution, PCBs have been detected in Arctic wildlife and ocean fish that are far from point sources (Agency for Toxic Substances and Disease Registry).

PCB Chemistry 101- The chemical structure of PCBs begins with two benzene rings (the biphenyl) which can have from one to ten chlorine atoms that substitute for a hydrogen atom on the numbered positions of the biphenyl – see figure below. PCBs were manufactured in the U.S. by Monsanto Corporation under the trade name Arochlor. Each Arochlor is a complex mixture of chlorobiphenyls and is described by a four digit number. The first two numbers, 10 or 12, indicate the carbon number; the last two numbers indicate the percent by weight of chlorine, where Arochlor 1254 for example contains 54% chlorine. The chlorine content causes PCBs to be either low-soluble liquids or even less soluble sticky resins as the chlorine content increases. Other trade names or references to PCBs that may turn up in an ESA include Pyranol, manufactured by General Electric; Dow-Therm, a heat transfer fluid manufactured by Dow Chemical; and Therminol, a heat transfer fluid manufactured by Monsanto and containing Arochlor 1242. Many other trade names and commercial formulations can occur. A list of PCB manufacturers and trades names is available in the PCB Inspection Manual (US EPA 2004) available at this link: https://www.epa.gov/compliance/polychlorinated-biphenyls-pcb-inspection-manual.



Basic polychlorinated biphenyl

PCB Chemistry, continued- When testing samples of oil or environmental media for PCB content, analytical laboratories can report a Total PCB concentration, or quantify the specific PCB number, known as a congener. This can allow a better understanding of the source and past use of PCBs that may have been released to the environment. Some of the more common PCB congeners detected are Arochlors 1016, 1221, 1232, 1242, 1248, 1254, and 1260 (U.S. EPA). The EPA analytical method (SW-846 8082) cites as many as 19 congeners to be reported. Further guidance exists when characterizing PCB releases to the environment, for example the National Oceanic and Atmospheric Administration (NOAA) method cites 20 congeners, and U.S. Army Corps of Engineers describes 22 congeners to be reported.

How to Consider PCBs in a Phase I ESA

The chemical properties and wide spread use of PCBs suggests that it would not be surprising to find them just about anywhere. The list of key PCB applications that should be considered in a thorough ESA is not infinite, but can be quite broad. A partial list follows.

Electrical transformers - Transformers are at the top of the list of PCB-containing equipment that is likely to be found in current or past use at a given facility. The PCB fluid is used for insulation, coolant and/or fire suppression. The facility or its power company can own or operate transformers, and would be responsible for upkeep and monitoring/reporting of PCB content and releases.

Capacitors - These are power-factor correction units similar to transformers that appear as rectangular boxes and may be located near high-power usage equipment like computer rooms and heating/cooling units. Non-PCB containing capacitors can be labeled as such, or have a manufacturer's nameplate that designates it is a "dry-type" and therefore are not likely be a REC.

Fluorescent Light Ballasts – PCB-containing capacitors are also found in the box-like ballast or resin material associated with fluorescent light fixtures.

Other electrical Equipment – PCBs can be found in switches, voltage regulators, circuit breakers, and oil-cooled electric motors. Oil-cooled electromagnets used in cranes for picking up metal and for metal separation in recycling may have PCBs. The nonmetallic recycled automobile material ("fluff") can have PCBs.

PCBs that occur in building caulking may require specialized removal prior to demolition.

Ballasts in fluorescent lighting, especially before 1986 can be PCB-containing.

Heat transfer fluids – used in a wide variety of non-contact industrial cooling applications; and **Hydraulic Fluids/Waste Oils** – see "*Is it a Rec Issue No. 3" September 2016* http://dpstudioenvironmental.com/news.html

Plasticizers – PCBs have been used as additives in polyvinyl chloride (PVC) plastic, neoprene, chlorinated rubber, laminating, adhesives, sealants, joint compounds, corrosion resistant paints, concrete, and other building materials. EPA has recently raised awareness that schools and other buildings constructed or renovated between 1950 and 1979 may have widespread occurrence of PCBs in caulk and other building materials.

Other Applications of PCBs – the list is not comprehensive, but PCBs and PCB-containing oils also have been used as spray for dust control; as an extender for the life of pesticides; in fire retardant coating; additives in printing inks; impurity in pentachlorophenol wood treating; and transfer agent for ink in carbonless copy paper (Source: ATSDR and others).

dpSTUDIO environmental consulting & design is an environmental engineering consulting firm anchored by senior engineers and scientists, each with more than 25 years of experience and supported by project staff and field technicians across the U.S. Our goal is to provide cost effective service on a fast-turnaround schedule to exceed your expectations.

Locations in Richmond, VA ◆ Denver, CO ◆ Providence, RI