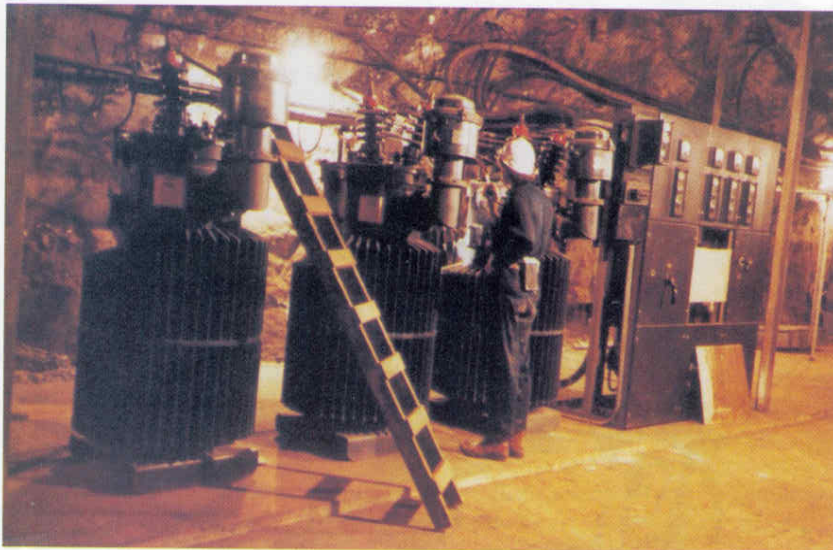


## Coal Operators Need to Retrieve Power Centers Before Abandoning Old Works

BY DAN BENCH



These are 76-gallon PCB transformers (the cylindrical objects with cooling fins and yellow PCB marks) on the 20 level of the Eagle mine at Gilman, Colorado during an EPA removal due to abandonment and flooding.

Electrical equipment containing polychlorinated biphenyls (PCBs) in underground mines has been documented during U.S. Environmental Protection Agency (EPA), Region No. 8, mine inspections conducted during the last 20 years. PCBs, which were used as dielectrics in transformers and capacitors, were common throughout all industrial sectors. The potential abandonment of electrical equipment unknowingly by mine operators could allow this rather nasty substance to enter the environment through ground water contamination in mining districts.

Polychlorinated biphenyls (PCBs) are a group of 209 man-made structurally related chemicals made in the U.S. from 1929 until 1977, when manufacture was voluntarily discontinued. In 1978, manufacture was prohibited under the Toxic Substances Control Act (TSCA). The TSCA was enacted in 1976 after the discovery that PCBs had become a worldwide environmental contaminant that had been detected in air, water, soils, and biosystems.

Despite the fact that its manufacture has been prohibited in the U.S. and many other countries, PCBs are still authorized for use in electrical equipment. The mining industry, especially coal, make extensive use of electrical equipment underground. If PCBs are released into ground water, toxic pollu-

tion occurs with no possibility of source retrieval. The result is water pollution for which there may be no solution.

### HEALTH AND ENVIRONMENTAL EFFECTS

PCBs are among the 12 chemicals designated as persistent organic pollutants (POPs) that are targeted by the U.N. Stockholm Convention of May 2001. A total of 151 nations signed the convention and agreed to reduce or eliminate PCB production, use, and/or release. The convention has been signed but not yet ratified by the United States. POPs are highly stable toxic organic compounds that persist in the environment and accumulate in fat. PCBs are one of several truly global environmental pollutants. They have been found in low, but measurable levels, in nearly all marine plant and animal specimens, fish, mammals, birds, bird eggs, and humans. Human exposure to PCBs occurs primarily via low-level food contamination. All U.S. residents have measurable PCBs in their fatty tissues<sup>1</sup>.

Fish can bioconcentrate PCBs in their tissues by a factor as high as 740,000 times the PCB concentration of the water they inhabit<sup>2</sup>. This does not include PCBs from consumption of contaminated invertebrates. Rainbow trout that consume contaminated invertebrates have been shown to bioaccumulate PCBs by a factor of 10 million

in Lake Ontario<sup>3</sup>. This process of bio-accumulation has resulted in the closure of fisheries in the Great Lakes and the issuance of PCB sport-fisheries advisories for fish consumption in 100% of the Great Lakes and in 71% of the coastal waters along with 28% of the lakes and 14% of the river miles of the lower 48 states, as of 2002<sup>4</sup>.

The oceans are the largest sink for PCBs, the consequences of which remain unknown. The median bioconcentration factors for PCBs from water into phytoplankton are between 10,000 and 1 million<sup>5</sup>, but it is seldom noted that phytoplankton are the basis of the ocean food chain and are a major source of atmospheric oxygen<sup>6</sup>.

In addition to being classified by the EPA as probable human carcinogens<sup>7</sup>, PCBs have been demonstrated to impair memory and intellectual development in children<sup>8</sup> and adults<sup>9</sup> and to cause human liver disorders, chloracne, and reproductive problems. PCBs are endocrine disruptors<sup>10</sup>, and are suspected to cause decreases in human sperm counts, increases in birth defects in reproductive organs, as well as increases in breast, prostate, and testicular cancers<sup>11</sup>.



PCB marked capacitors in a coal mine power center.

The physical and chemical properties that make PCBs valuable commercially also make them environmentally detrimental. PCBs are very stable compounds which resist breakdown from high temperatures



and aging. Once in the environment PCBs persist for long periods of time: they can easily cycle between air, water, and soil and become distributed worldwide<sup>12</sup>.

### KNOW WHERE TO LOOK

Abandoned electrical equipment that contains PCBs is likely to cause water pollution that can affect the environment and the health of downstream fish, wildlife, and human populations. Surface and underground facilities alike can harbor PCBs. PCBs are most likely to be in transformers, drums of used transformer oils, capacitors, and fluorescent light ballasts. Transformers may be grouped in permanent substations, located singly, or mounted on mine cars that can be transported throughout the working areas of the mine.

Capacitors are generally found in locations similar to those of transformers. PCB capacitors have been found in electric locomotives. In coal mines, capacitors are often in wheel or skid-mounted power centers. PCB transformers and capacitors have been found in hoists, load out facilities, and breaker houses. Fluorescent light ballasts can contain regulated levels of PCBs in the potting compound and internal capacitors. The PCB regulations require these items be identified by PCB marks (or labels) if they contain 500 ppm (0.05%) or more PCBs and they are termed PCB transformers or capacitors. Equipment with even lower concentrations of PCBs may constitute significant threats to the environment.

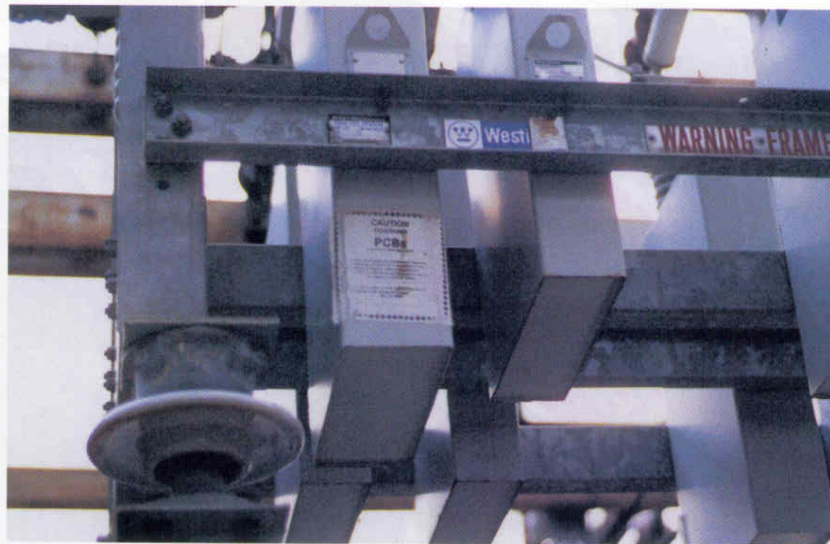


Mine power centers containing PCB capacitors outside an underground Utah coal mine.

Large mines can require hundreds of electrical substations and/or power centers that may harbor PCB electrical equipment. PCB transformers and capacitors have been found at open pit coal mines in surface substations, shovels, and drag lines. However, one should not get the impression that only large mines have PCB electrical equipment.

### PCB MANAGEMENT AND DISPOSAL

The first task is to inventory the PCB electrical equipment to identify it and its location.



Mine operators should look for warning labels and document location of electrical equipment that contain PCBs.

Equipment should be marked so that it is easily recognizable, protected, and not inadvertently disposed. Written records are essential.

Depending on finances, the second task is to replace the equipment and remove it to safe storage according to government regulations. The third task is disposal. It is of utmost importance to keep in mind the dangers and persistence of PCBs in the environment when deciding on storage locations and disposal. Open burning can convert PCBs to even more hazardous dioxins and dibenzofurnas. Disposal of PCB dielectrics in landfills can contaminate ground water. PCB dielectrics require specialized disposal techniques that can destroy the PCB molecule. In some countries, there are no adequate disposal facilities so that long-term storage will be necessary.

A mining engineer, Dan Bench is the region 8 PCB coordinator, U.S. Environmental Protection Agency (E-mail: Bench.Dan@epamail.epa.gov or 303-312-7090). For more information on PCB regulations, check [www.epa.gov/pcb](http://www.epa.gov/pcb).

#### Editor's Note

The views expressed in this article express the opinions of the author and do not necessarily reflect EPA policies.

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