THE
ROLLINS
ENVIRONMENTAL SERVICES, INC.
REPORT

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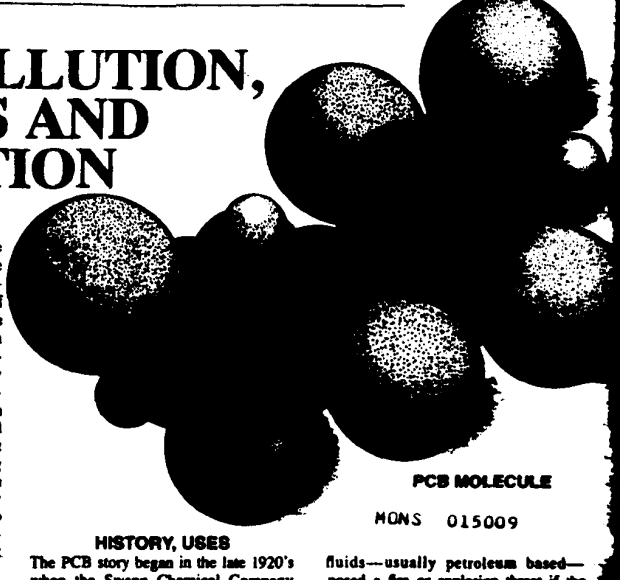
PCBs: POLLUTION, POLITICS AND PREVENTION

by Steven Jellinek

Polychlorinated biphenyls (PCBs) are the only chemical substances whose manufacture and distribution in commerce is specifically banned by an act of Congress. When Congress passed the Toxic Substances Control Act (TSCA) in 1976 to bring all existing and new industrial chemicals under a regulatory umbrella, it included several special provisions which focused on PCBs. Section 6(e) not only prohibited the making and selling of PCB's after July 1, 1979, but it also limited the continued use of existing PCBs to those which are contained in totally enclosed machinery. Opportunity was provided for limited exceptions to the manufacture and use bans, but Congress' intent to end or phase out the built of PCB manufacture and use was clear. In addition, section 6(e) directed EPA to strictly regulate the marking, storage, and disposal of PCBs. In the past seven years, EPA has issued a series of regulations to accomplish these Congressional directives.

ABOUT THE AUTHOR:

Steven D. Jellinek was Assistant Administrator for Pesticides and Toxic Substances at the Environmental Protection Agency from 1977 to 1981, during the time that PCB regulations and many of the other initial regulations implementing TSCA were promulgated. He now heads Jellinek Associates, Inc., a Washington, D.C., consulting firm.



PCB MOLECULE

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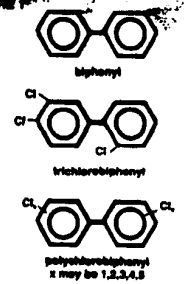
HISTORY, USES

The PCB story began in the late 1920's when the Swann Chemical Company (later acquired by Monsanto Company) developed a family of partially or wholly chlorinated isomers of biphenyl (see figure 1). These materials had some remarkable properties. They were relatively insoluble in water, they were able to withstand high temperatures without degradation, and they would not conduct electricity. In short, they were extremely stable compounds and the potential industrial benefits of these materials—particularly as flame retardants in the electric power industry—soon became apparent.

Large electric transformers, for example, use dielectric fluids as insulating materials. Before the 1930's, these dielectric fluids—usually petroleum based—posed a fire or explosion threat if the transformer overheated. PCBs not only avoided this problem, but were considerably better as insulators than previously used materials. PCBs were also found to be an ideal material for insulation in electric capacitors (before manufacture was discontinued, transformers and capacitors accounted for 63 percent of all PCBs made in the United States).

Other uses were discovered. Heat exchangers and similar heat transfer systems could benefit from the unique properties of PCBs, as could hydraulic systems in which there was a risk of fluids igniting. Finally, PCBs found their way into paints, adhesives, plasticizers, paper coatings, ink, and carbonless copy paper.

FIGURE 1



Ironically, it was precisely the beneficial properties that made PCBs such uniquely desirable industrial products which caused their withdrawal from the marketplace. PCBs are extremely persistent organic chemicals, and degrade very slowly in the environment. Their chemical structure is similar to that of DDT, they are insoluble in water but soluble in fat, and thus can be absorbed by human tissue.

Because of their widespread use they are distributed throughout the environment. PCB residues have been found in fish or wildlife all around the world. The first report of possible environmental problems with PCBs was published in a British scientific journal in 1966 by a Swedish scientist who discovered that PCBs were bioaccumulating in fish and other wildlife in Scandinavian countries. Two years later, PCBs made headlines in the popular media for the first time when a number of residents of Yusho, Japan became seriously ill after eating rice oil contaminated with high concentrations of PCBs. Soon after sampling, and as monitoring began to expand and intensify, PCBs were discovered in oysters and other shellfish in Florida, in Great Lakes fish, and throughout the United States in human fat tissue. By 1970, scientists in the United States were reporting that PCBs seemed ubiquitous in the environment in very small quantities, and that they were accumulating in the food chain.

PHASE-OUT AND BAN

The first response of the PCB producing industry to the disclosures of environmental accumulation was to eliminate voluntarily in 1970 major dispersive uses such as in inks and paints. The following year, PCB use was ended in plasticizers, hydraulic fluids, and similar "partially closed" systems. In 1971, the Food and Drug Administration acted to prevent the accidental contamination of food by PCBs used in heat transfer applications and to prohibit the use of fibers containing PCBs in food packaging. However, immediate removal of PCBs from "closed" electrical systems—principally transformers and capacitors—in the absence of available alternative materials or machinery, would have meant a near total shutdown of the electric power generating industry in the United States.

In the fall of 1971, the Federal Government established an Interdepartmental Task Force on PCBs, chaired by the Council on Environmental Quality and the Office of Science and Technology. The Task Force report of May, 1972 concluded, among other things that:

- PCBs have been used so widely over such a long period that they are ubiquitous.
- PCBs should be restricted to essential or nonreplaceable uses which involve minimal direct human exposure, since they can have adverse effects on human health.
- The major gap in the regulatory system to deal with PCBs is broad Federal authority—as would be provided by the (then) proposed Toxic Substances Control Act—to restrict use or distribution of the chemical, to control imports, and to collect information.
- The use of PCBs should not be banned entirely as these materials are necessary in the near future for transformers and capacitors.

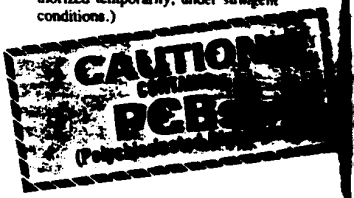
While TSCA was pending enactment, an agreement was worked out between PCB manufacturers and users and the Environmental Protection Agency to continue the use of PCBs in closed systems until alternative materials were developed, at which time PCBs would begin to be phased out. Subsequently, on October 31, 1977, Monsanto Company—the only remaining U.S. producer—shut down all its PCB production facilities, a year and a half before the Congressional ban on manufacturing was to go into effect.

REGULATORY REQUIREMENTS

With so much of the dispersive and related uses of PCBs ended, and with manufacturing no longer underway, EPA's TSCA regulation focused on the PCBs that were still being used, primarily in various electrical devices, and on the disposal of PCBs that had been, and would continue to be, taken out of service. In two major regulations in 1978 and 1979, EPA implemented the Congressional directives contained in Section 6(e) of TSCA. These regulations are found in Title 40, Part 761 of the Code of Federal Regulations (CFR).

Subpart A of Part 761 specifies who the regulations apply to, defines the various terms used in the regulations, and gives additional references. Subpart B states specific practices that are authorized or prohibited. Subpart C defines and illustrates how PCB containers, articles, etc., must be marked. Subpart D states specific requirements for disposal, storage, incineration, landfilling, and decontamination of PCB containers. The final section, Subpart J (there are no Subparts E through I), prescribes what records must be kept and what monitoring activities must be conducted. A summary of the major provisions of the regulations follows:

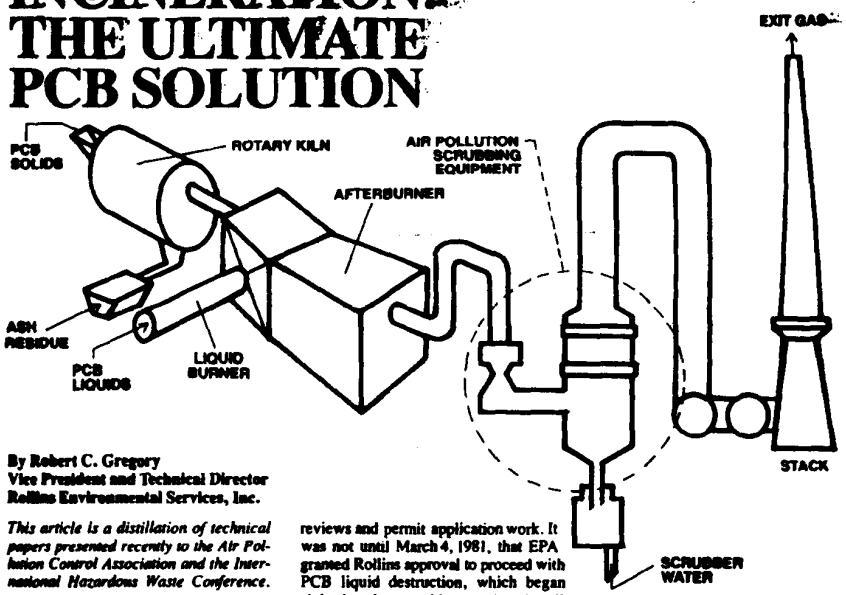
- PCBs cannot be manufactured, processed, or distributed in commerce unless specifically exempted by EPA.
- PCBs may only be used in a totally enclosed manner, defined as a manner that results in no exposure of humans or the environment to PCBs. (Several non-totally enclosed uses were authorized temporarily, under stringent conditions.)



- All items containing 50 ppm PCBs or greater must be specially labeled and stored. Storage facilities or methods must be capable of preventing any release to the environment should PCBs leak from containers or articles. Furthermore, PCBs that have been taken out of service for disposal can only be stored for one year.
- All PCBs in concentrations greater than 50 ppm and all PCB-containing items must be disposed of in incinerators, in chemical waste landfills, in high efficiency boilers, or by alternative methods approved by an EPA Regional Administrator.
- Liquid PCBs in concentrations above 500 ppm and PCB capacitors *must* be disposed of in approved incinerators. The EPA standards for PCB incinerators are considerably more strict than for hazardous waste incinerators. The latter must meet a destruction and

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INCINERATION: THE ULTIMATE PCB SOLUTION



By Robert C. Gregory
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This article is a distillation of technical papers presented recently to the Air Pollution Control Association and the International Hazardous Waste Conference.

Incineration is generally accepted to be the most efficient and environmentally sound way to dispose of high concentrations of polychlorinated biphenyls (PCBs). This was recognized when the Environmental Protection Agency (EPA) issued its PCB regulations, which call for the incineration of materials or articles that contain more than 500 parts per million (ppm) of PCBs. Since the regulations were originally written, several mobile and *in situ* treatment systems have been permitted to destroy or treat PCBs up to the several thousand ppm level, but incineration—which can handle even pure PCBs—still remains the most widely used method of eliminating high concentrations of PCBs from the environment.

Permitting the first PCB incinerator in the U.S. was not an easy task, however. On April 5, 1978, Rollins made its original application for approval to incinerate PCB compounds and wastes at its Deer Park, Texas, hazardous waste disposal facility, operated by Rollins Environmental Services (TX) Inc. The application required many months of technical reviews and permit application work. It was not until March 4, 1981, that EPA granted Rollins approval to proceed with PCB liquid destruction, which began eight days later, and has continued until the present.

In 1979, Rollins submitted an application for permission to incinerate PCB contaminated solids, principally capacitors. A test burn was finally conducted two years later, and a solids permit was granted to Rollins in January, 1983. During this same time period, ENSCO Inc. was granted permits to burn liquid and solid PCBs at its facility in El Dorado, Arkansas.

The long lapses between permit applications and permit approvals are evidence of the enormous amount of work required both by permit applicants and by EPA. A PCB incineration permit was virgin regulatory and technical territory, and everyone concerned wanted to make certain that the process was conducted properly to insure maximum environmental protection.

Since Rollins was granted its PCB incineration permit, the company has destroyed tens of millions of pounds of these materials. In both the initial test burns and in subsequent monitoring, as near total destruction as is possible has been certified.

Liquid PCBs usually require no pretreatment before incineration. They typically arrive at the plant in bulk, usually via truck, and are incinerated in the liquid unit of the incinerator. For PCB solids, however, usually the entire device (e.g., a capacitor) arrives at the plant intact and these devices must be shredded before they can be burned.

An automated system that shreds capacitors, separating liquids and solids, virtually eliminates human contact with the devices while they are being processed. All materials are weighed before and after shredding to certify that all materials are accounted for. Solids that result from the shredding process are burned in the rotary kiln portion of the incinerator.

A computerized recordkeeping system keeps track of all Rollins PCB activities: PCB bins, specially constructed to provide for temporary storage of nonleaking PCB articles, are recorded when they leave the Rollins facility and when they arrive at a customer's location. These

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bins—as well as any other PCBs or PCB articles—are identified and weighed when they are received by Rollins.

The computer also keeps track of PCB materials while they are in storage at Rollins or elsewhere to make certain that mandatory storage limits are not exceeded. As mentioned earlier, the shredding process is monitored, and this information also is stored in the computer. When PCBs or PCB articles are incinerated, the computer is again watching and weighing, thus completing a record that provides customers and regulatory agencies with absolute records regarding receipt, handling, and destruction.

The PCB incineration process itself is probably the most highly regulated industrial activity in the United States today with the exception of nuclear activities. PCB incinerators must meet operating and performance criteria that go substantially beyond requirements for hazardous waste incinerators. For example, destruction efficiency must be at least 99.9999 percent—the most stringent destruction efficiency required in the world today.

To insure that regulatory requirements are met, an independent engineering company makes unannounced, random inspections of incinerator and related operations several times a month. During these inspections, 21 separate control parameters are checked, instrument calibration is verified, records are examined, and a variety of other operations are certified. The engineering company makes its reports directly to EPA.

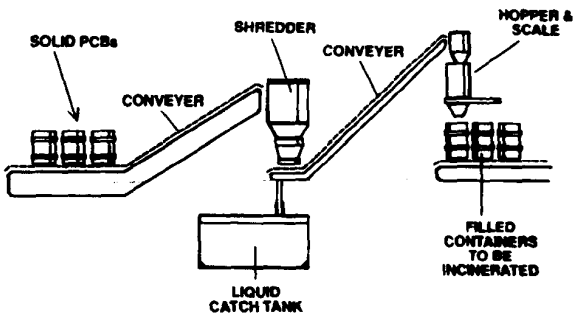
During inspections, the automatic shutdown feature of the incinerator also is tested. This system immediately shuts down the incinerator if any one of a variety of parameters is violated, including temperature, emissions, and others. Intentional upsets may be caused to test the shut-down controls.

In all tests to date, no PCBs, other chlorinated hydrocarbons, or EPA priority pollutants have been found in the exhaust gas. Less than 1 ppm PCBs has been found in the incinerator ash, and less than 1.5 micrograms per liter of PCBs have been found in the unit's scrubber effluent. Other tests have not been able to find tetrachlorodibenzo-p-dioxin or tetrachlorodibenzo-p-furan at detectable levels as a result of the incineration process.

It would seem that all of these controls and precautions would make it axiomatic that regulated, controlled disposal facilities using proven technology to destroy PCBs is preferable to long-term storage at many different industrial locations, but this is not necessarily axiomatic with the public. Despite the fact that the Rollins Deer Park incinerator is an almost miniscule facility in the midst of a vast industrial complex, public opposition to the burning of PCBs was initially strong and hostile.

However, in the more recent past, much of this opposition has disappeared, and when a hearing was held on the issuance of the PCB solids permit in late 1982, only a handful of persons attended.

For over a decade the popular media have been applying adjectives such as "deadly toxic" and "carcinogenic" to PCBs. With the possible exception of agent orange and asbestos, PCBs are probably the best known "political pollutant." This popular attitude may never be completely overcome, but the exceptionally good record of PCB incineration in the U.S. to date seems to be helping.



PCB capacitor shredding system is automated and enclosed; all materials are weighed before and after shredding.

While this article has necessarily concentrated on Rollins, the principles it includes can be applied to any well-operated PCB incineration facility, and may be useful to those companies that have PCBs which must be disposed of. Technical reports about the performance of the Rollins PCB incinerator are available from the company.

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removal efficiency rating of 99.99 percent; incinerators burning PCBs must meet a destruction efficiency of 99.9999 percent.

- Liquid PCBs in concentrations of 50 to 500 ppm, and other PCB equipment and containers, properly drained, may be disposed of in chemical waste landfills.
- Mineral oil from PCB-contaminated transformers and other liquids containing PCBs in concentrations of 50-500 ppm may be disposed of in high efficiency boilers.

Although the PCB disposal regulations were initially published in 1978, it was not until March, 1981 that the first commercial incinerator was permitted by EPA for PCB destruction. This unit was—and still is—operated by Rollins Environmental Services (TX) Inc. near Houston, Texas. Shortly thereafter, another incinerator, operated by ENSCO, Inc., at El Dorado, Arkansas, was also permitted to burn PCBs. These two facilities are still the only two large commercial U.S. incinerators licensed to destroy PCBs. A mobile incinerator developed and built by EPA is undergoing tests and also may soon be permitted. Several companies have received permission from EPA to incinerate PCBs which are generated as unavoidable by-products of manufacturing processes, but these facilities are not permitted to burn PCBs from other sources.

A number of chemical treatment systems—many of them portable—have been developed to transform PCBs into nonhazardous chemical substances. However, these are useful primarily for materials containing less than 2,000 ppm of PCBs; commercial incinerators burn materials that contain as much as 800,000 ppm of PCBs. Still other systems have been proposed for PCB destruction, and some have proved successful in laboratory tests. However, the bulk of materials containing more than 500 ppm of PCBs are incinerated, and most of the materials that contain between 50 and 500 ppm of PCBs are disposed of in chemical waste landfills.

RECENT RULE CHANGES

As the result of a successful lawsuit challenging parts of the 1979 regulations which concerned totally enclosed and temporarily authorized uses, EPA was required to make several significant changes to the regulation of PCBs. These were published on August 25, 1982, and include:

- Prohibition after October 1, 1985, on the use of transformers and electromagnets with more than 500 parts per million PCBs if they pose an exposure risk to food or feed.
- Weekly inspections of the equipment until then.
- Authorization for the continued use of all other PCB transformers for the remainder of their lives, but a requirement that they be inspected quarterly for leaks.
- Authorization for the continued use of large PCB capacitors located in restricted-access electrical substations or restricted-access indoor installations, without inspections.
- Prohibition after October 1, 1988, on the use of all other PCB capacitors.

In addition, EPA promulgated the first of two regulations dealing with PCBs that are produced as incidental by-products in chemical processes. None of the new PCB rules, however, change the basic disposal and destruction requirements contained in Title 40, Part 761 of the CFR.

This article has tried to provide general information on federal rules governing the manufacture, use, and disposal of what is probably the most highly regulated industrial chemical in the United States. The story of PCBs is a classic one in the history of health and safety regulation. It shows how a substance once thought to be stable and safe became a household code word for toxic pollution, and how society, through the political process, moved to restrict its release into the environment.



Total PCB Management

Rollins performs a complete spectrum of PCB management activities, in conformance with recent EPA regulations requiring phase-out of certain PCB uses.

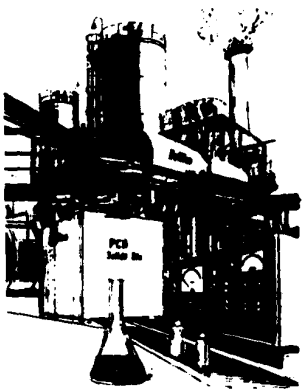
Our Texas subsidiary is permitted by federal and state agencies to manage PCB liquids and solids. All our subsidiary companies have emergency teams available around the clock to manage PCB spills or to respond to situations requiring immediate action.

Since receiving the first EPA permit to incinerate PCBs in 1981, millions of pounds of liquid waste containing high concentrations of PCBs have been incinerated by Rollins at our Deer Park, Texas, facility with a destruction efficiency of at least 99.9999 percent. Standard operating procedure is to incinerate PCB liquids within ten days of receipt at our treatment facility.

Field services teams specialize in cleanup, flushing, collection and packaging. We transport liquids in our own fleet of specially designed trucks, and provide reusable bins for approved outdoor storage and transportation of solids.

For any PCB service, from consultation to destruction, Rollins has the hands-on experience needed to find the best and most cost-effective solutions, and execute them timely.

If you want to expand your PCB management and disposal options, call Rollins first.



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