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# Toxic Substances and the Bureaucratic Quagmire

by Steven Schopler

**"Suddenly, as if the were newly discovered, PCBs have become a cause celebre of many organizations and individuals seeking their universal ban."**

Virtually everyone from the tot to the tottering is aware of the national effort to fight environmental pollution and occupational safety hazards. A glance at city skylines or the shorelines of our waterways will convince even the skeptic that real progress has been made in *eliminating dangerous and* repulsive pollutants from our air and water. Equally hazardous contaminants have been eradicated from our workplaces — and for these successes the environmental movement is rightly proud. But in 1976, the question is no longer "Do we want safe working conditions and a clean environment?" What we must now ask ourselves is "How safe, how clean, and how much are we willing to pay for *these benefits*?"

A growing number of Americans are concerned that very small improvements in our environmental quality are no longer worth the enormous investments they require. Consumers pay doubly for these improvements since we not only must bankroll industry's investment in pollution control but pay taxes which support a vast toxic substances bureaucracy.

The federal government has created within itself a veritable alphabet soup of agencies whose purpose is to protect us from the toxic substances that are the distasteful realities of twentieth century life. Among these agencies are OSHA (Occupational Safety and Health Administration), EPA (Environmental Protection Agency), FDA (Food and Drug Administration), CPSC (Consumer Products Safety Commission), NIOSH (National Institute for Occupational Safety and Health), GAO (General Accounting Office), NIH (National Institutes of Health), DOT (Department of Transportation), NBS (National Bureau of Standards), and others. All have established regulations or research programs involving toxic substances. How can these substances affect us as engineers and how can we deal with the bureaucratic quagmire of toxic substances control?

Toxic chemicals can affect the lives of millions. Consider the recent developments concerning Polychlorinated Biphenyls, or PCBs. These are members of a family of compounds wherein chlorine atoms are substituted for hydrogen atoms on the biphenyl molecular "skeleton". PCBs were used extensively in the United States from the 1940's to 1971. Because the compounds are chemically inert and thermodynamically stable to high temperatures, PCBs found wide



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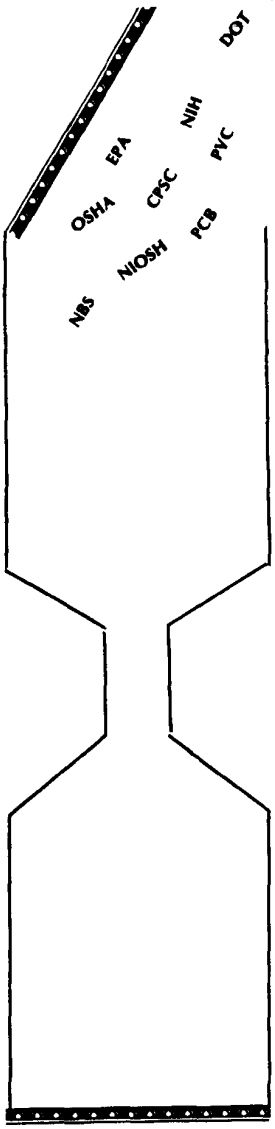
application as plasticizers in paints, textiles, investment casting waxes, inks, paper products, and other surface coatings. Because of their resistance to explosion and high dielectric constant, the compounds were (and still are) used as a dielectric fluid in power capacitors and transformers large and small. The greatest quantities of PCBs were manufactured for use in electrical applications, as heat transfer and hydraulic fluids, and in carbonless copy paper.

In 1968, after millions of tons of PCBs had been manufactured and distributed, a leak in a PCB-filled heat exchanger in a Japanese rice oil factory resulted in the accidental poisoning of thousands of Japanese citizens who consumed the contaminated oil. The incident caused on immediate fatalities, but the consequences of the event included several miscarriages, persistent cutaneous acne, facial edema, and other symptoms which have persisted in the victims of PCB intoxication to this day.

Soon after this outbreak, the toxicity of PCBs became widely known and Monsanto Industrial Chemicals Company, the only U.S. manufacturer of PCBs, voluntarily restricted its sales to "closed systems" applications. Engineers sought substitutes for PCBs and better methods for controlling them in the environment. Although the chemicals appeared to be under control by Monsanto's restricted sales policy, further study revealed that PCB concentrations were continually rising in air and water samples from across the United States. Due to their lipophilic properties, PCBs accumulated in the fatty tissues of freshwater fish and marine life. Toxicity studies have shown PCBs to have harmful effects on monkeys in diet concentrations as low as two parts per million (ppm).

Suddenly, as if they were newly discovered, PCBs have become a cause celebre of many organizations and individuals seeking their universal ban. PCBs have just as sudenly become the headache of the year for industrial




capacitor manufacturers, investment casting foundry operators, and paper recyclers threatened with federal regulations requiring the expenditure of millions of dollars for the monitoring and control of PCBs at parts per million levels in their effluent discharges. (It is ironic that the environmentally concientious paper recycling industry should bear much of this cost. The industry's only connection to the chemicals is in the recycling of years-old paper products that already contain them as a component of inks and coatings.)

Keeping in mind that not a single case of PCB intoxication has ever been reported in the United States, consider the expenditure and involvement of the federal bureaucracy. The EPA has held two national conferences on the subject, sponsored numerous studies, collected volumes of information, and after more then 24 months of deliberation, published what could be called "guidelines" to hasten the elimination of the chemicals from industrial use. The FDA has ordered the destruction of tons of commercially caught fish found to contain more than the FDA limit of 5 ppm. PCBs. The FDA has also collected volumes of data in an as yet incomplete attempt to modify its own maximum allowable contaminant levels for PCBs in processed food, food packaging materials, milk, and baby foods. The Department of Transportation has been involved in devising safe means of packaging and transporting PCBs as well as developing procedures for handling PCB spills. The NBS is in the process of developing standardized mthods for the quantitative analysis of PCBs in concentrations as low as a few parts per trillion. OSHA and NIOSH are concerned with the protection of workers involved with the handling or manufacture of PCBs or PCB-containing products. The GAO audits the functions of all these other agencies, making certain the taxpayers get their money's worth in toxic substances protection.



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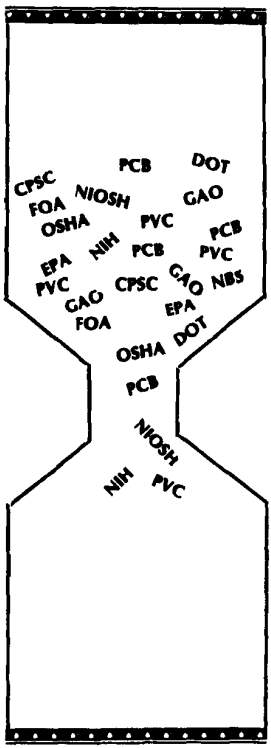
These agencies are under constant pressure from proponents on both sides of the issue. Environmentalists want stricter, more positive action on PCBs and have initiated lawsuits to get it. Some industries, such as Wisconsin's paper recyclers, claim they will go bankrupt from the vast expense of "nonproductive" pollution control equipment that may be required by proposed federal requirements. In 1975 over 15,000 jobs were lost as pollution control requirements forced the closure of more than 75 plants in the United States.

Another of the many examples of the toxic substances dilemma is the controversy surrounding the plastic Polyvinyl Chloride, also known as PVC. This material is used in products too numerous to mention. When OSHA and NIOSH studies revealed that workers in PVC plants had developed an unusual number of cases of angiosarcoma, a rare liver cancer, the cause was traced not to polymerized vinyl chloride, but to vinyl chloride monomer gas which escaped the polymerization process. Besides the concern for worker exposure at vinyl chloride plants expressed by OSHA, the FDA became aware of vinyl chloride monomer migrating by diffusion from food packaging plastic to the container contents. Next, the EPA sought to locate sources of vinyl chloride monomer escaping to the atmosphere or leaching from landfill sites into fresh waters.

In addition to the cost of the bureaucratic involvement in toxic substances (EPA's budget for fiscal 1975 and $749 million), the cost of industrial controls must be added. In the case of PVC, the B.F. Goodrich Company, one of the largest PVC manufacturers in the world, spent $36 million in the company's largest research effort ever, in order to meet the federal requirements. OSHA's 1 ppm employe exposure limit (averaged over a time-weighted 8 — hour period), EPA's atmospheric emissions limit, and FDA's food packaging standards were all met or surpassed by B.F. Goodrich's new "clean" polymerization process for vinyl chloride. Certainly these actions have resulted in a marginal improvement in our environmental quality, but the costs of implementing the new standards industry-wide will be reflected in higher costs to all consumers.




Destined to increase industry's expenses still further is pending legislation known as the Toxic Substances Control Act. This bill gives the EPA control over the manufacture and distribution of chemcial substances in interstate commerce. Under the act, the EPA would also be able to screen chemicals before they are released to the market, with manufacturers required to submit their own test data to the EPA. The bill was introduced in February 1975 by Sen. John Tunney (D-Calif.) who said, "The premarket screening provisions of this bill go to the very heart of a proper toxic substances program. Without it, or with a limited review (as prescribed in similar bills), there is virtually no way that vinyl chloride—like experiences might be avoided on a timely basis in the future."

EPA Administrator Russell Train estimates that the bill would cost the chemical industry $45 million annually. The Manufacturing Chemists Association estimates these costs at $1.3 billion. The actual cost of the bill's enactment is likely to be somewhere between these two extremes, but whatever the cost, we consumers will bear it in the end.

One of the biggest complaints industry registers against the toxic substances bureaucracy is that despite the research and extensive study undertaken by industry and the academic community, decisions on toxic substances are often based on very little scientific data. Last March, Glenn Schweitzer of EPA's Office of Toxic Substances stated that, "At the present time decisions are being made on the basis of very sparse data."

A prominent example would be



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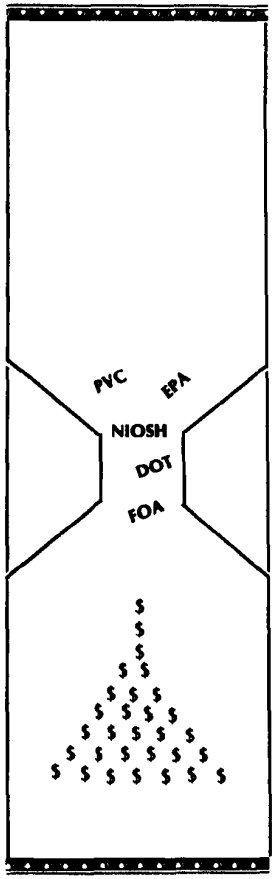
last December's decision by Russell Train to order an immediate halt to most uses of the pesticides Chlordane and Heptachlor, daspite an earlier recommendation by an EPA administrative law judge that the carcenogenicity of the pesticides had not baen proven. Administrator Train replied that it is now necessary to find conclusively that harm will come to humane if the pesticides are used; rather, he based his action on the finding that their continued use would likely result in an "unreasonable risk to man." Train's decision temporarily suspends the use of Chlordane and Heptachlor. Hearings are to be held to determine whether to permanently cancel all use of the chemicals. The hearings are expected to last 18 months.

This kind of reasoning rankles industrialists who claim that currant methods of testing chemicals and formulating federal regulations on their use are stacked against them. First, it is impossible statistically to prove that a chemical does not cause harm. It is only possible to show with a certain level of confidence that a chemical is likely to cause harm. Secondly, present methods of chemical screaning reject the concept of a "no effect" level of a chemical simply because such a level cannot be demonstrated for the reason just mentioned. Since the "no-effect" level is disregarded, laboratories test chemicals by subjecting animals to doses many times greater than a human would be likely to encounter. In this way, the chances of possible tumor formation are greatly accellerated, reducing the time span of the test which otherwise would take years to complete. If malignant tumors are found in the animals, the carcenogenicity of the chemical is "proven". If benign tumors are found, the mutagenicity of the chemical is "proven." If the animals' offspring are deformed, the chemical is a proven teratogen.

To complicate matters still further, analytical techniques are being improved to detect lower and lower levels of chemical contamination in air, food, and water. This opens the discussion to the question "When is a substance 'free' of chemical contaminants?" To give some idea of the quantities involved, consider that one part per trillion is roughly equivalent to the contamination of 15,000 cubic feet of pure water by a single grain of salt. Chemists have already detected some chemical contaminants at parts per quadrillion levels!




The question that arises in the engineering and industrial community is "What can be done to protect our workers, our environment, and our community reputation from an inadvertant conflict with the plethora of federal toxic substances regulations?" Since there are regulations governing the use, transportation, and disposal of substances from the most common solvents (e.g. ketones) to the most deadly radioactive elements, the only answer to this question is simply "Be aware!" Every toxic substance and occupational safety regulation may be found in the Code of Federal Regulations (CFR). This is a 50—volume set containing every federal regulation now in effect. It also includes comments on the intent, enforcement, and penalties for the violation of each.

New regulations are additionally published in the Federal Register, a daily periodical conteining written accounts of all actions by federal agencies. Although federal regulations are most complete in their published forms, effective use of the CFR or the Federal Register is not simple. An easier approach is to telephone the appropriate Washington agency and make an inquiry. Once the correct person is contacted, one can usually obtain enough information to make better use of tha writtan regulations. The United States Government Manual 1975/1976 is one of the best available directories of federal agencies. It contains a brief description of the function, structure, and leadership of every government agency as well as important addresses and phone numbers.

To anyone who expects to be professionally involved with chemicals of any sort - from cleaning fluid to heavy watar-this writer advises "Be aware of those federal regulations!"

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*Steve Schopler is a senior in mechanical engineering, currently studying bio-medical engineering. He is also a science and technology intern for the Wisconsin Legislative Council Staff.*



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**Dear Editor:**

I am currently employed by G.T.E. Automatic Electric Laboratories Incorporated located in Northlake, Illinois. My job consists of the design and development of service circuits for various sizes of common control type telephone switching systems.

For students interested in communications circuits I strongly recommend the communications laboratory (E.C.E. 455). The design project in that course is a rare and valuable practical experience. A good balance of communications theory with circuit theory is vital. Digital, linear, and non-linear circuit theory should all be covered. Any additional studies in these areas would be helpful; particularly digital logic design.

Stephen A. Saindon

**Editor:**

I am now working at Wisconsin Electric Power Company in Milwaukee, Wisconsin. Since graduation have been involved in a one-year formal training program. This consists of assignments ranging in length from two to five months in four locations—two in power plants, one in Budgets and Results, and one in Engineering and Construction. Specific assignments have included turbine efficiency tests, heat rate tests (BTU's/KWH), designs to repair or improve plant facilities, and design and installation of test equipment for the environmental department.

Two courses I have found very useful in my work are mechanical design and fluid mechanics.

Robert R. Hubinger


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