

CHAPTER 3

PCBs: Another Global Pollutant

Just as with mercury, two pollution disasters called attention to the effects of PCBs (polychlorinated biphenyls) and related chemicals on children's development. Following those disasters, researchers initiated long-term studies of the prenatal effects of low-level exposure to PCBs. PCBs are extremely stable chemicals. Like mercury, they are distributed around the globe and biomagnify up the food chain.

Most PCB exposure now occurs through food. But older electrical equipment can have PCBs inside. When I was a graduate student at the University of Illinois, sometimes I studied in a building where the ballasts on the fluorescent lights were gradually going bad. When one went out we would first smell a slight burning odor. Then a gooey black spot would gradually appear on the translucent light cover overhead. Some kind of oily gunk had dripped onto the light cover from above. The burning and dripping goo very likely contained high concentrations of PCBs. But in 1975 we had no idea the oozing black stuff might be toxic. Now the EPA recommends immediately evacuating a room with a broken fluorescent ballast. The room should be ventilated as well as possible. Then the mess should be cleaned up while wearing gloves and a special respirator. The cleanup rags and gloves should be double-bagged and taken to your community's toxic disposal program.¹ But in 1975 that didn't happen. We just kept studying. Usually it was a couple of weeks before the light was repaired.

What is the chain of evidence leading the EPA to recommend evacuation, ventilation, and special disposal of PCB contaminated items?

Three conditions are normally necessary for scientists to conclude that a specific type of pollution is harmful to people. *First*, the results of a "landmark" human epidemiological study or poisoning incident need to be supported by other studies that find similar effects. *Second*, researchers need to find effects on laboratory animals that are analogous to the effects on humans. This piece of

the puzzle is needed because environmental pollution in humans and wildlife does not occur just one chemical at a time. Epidemiological studies of humans cannot draw strong causal conclusions because there are always confounding variables. People are exposed to multiple pollutants, smoking, alcohol use, family background, and so on. Of course these other variables can be included in the analyses. But in principle there is always the possibility that another unmeasured confounding variable could account for the results. Finding a correlation does not imply causation. Laboratory animals can be randomly assigned to different levels of exposure to a pollutant. Random assignment to conditions in an experiment is one key to drawing a cause-effect conclusion. *Third*, laboratory research needs to show that the pollutant affects biological processes in a way that could plausibly account for the effects in people. When committees of scientists review pollutants for the EPA, they look at all three kinds of evidence. Then they decide whether the weight of the evidence supports regulating a pollutant.

In evaluating evidence against a pollutant, the decision criteria discussed in the preceding chapters are important. There are no hard-and-fast rules for deciding that a pollutant has effects on children's development that are serious enough to require regulation. Is it enough to have one long-term study of humans that shows negative effects, even if the results of other studies do not completely agree? Is it enough to have laboratory evidence that a pollutant disrupts brain chemicals and hormones in developing animals? Is it enough to show that a pollutant disrupts a biological process such as the gene signaling involved in normal brain growth?

The first study of the long-term effects of prenatal exposure to low concentrations of PCBs was conducted in Michigan starting in 1980. This study became the centerpiece of debates over how much PCBs should be regulated, and how thoroughly they should be cleaned up. Partly because of the Michigan study, there are warnings about consuming certain Great Lakes fish. I will describe this study in some detail, along with the scientific differences of opinion about the interpretation of the findings. But first, background and a pollution disaster.

Some Background on PCBs

The family of chemicals known as polychlorinated biphenyls (PCBs) were first synthesized just before the start of the twentieth century. PCBs have desirable electrical properties, are chemically stable, and resistant to exploding when heated. Because of their desirable properties, by the 1930s PCBs came into wide use in electrical transformers, for lubrication, and in many other products. For a short time PCBs were even used in paints in farm silos.² A partial list of uses of PCBs is in Table 3.1. Prior to the advent of PCBs, explosion