From Factories and Tank Cars to You: Hazards of Manufacturing and Transporting Pesticides

By Caroline Cox

Pesticides are ubiquitous in our bodies and the environment. Pesticides have been found in the air, rivers, groundwater, fog, soil, and in human, animal, and plant tissues. "But there's no need to worry," is a common response. "What's been found is a tiny amount, just several parts per billion or million. Those are minute amounts; in fact, just a few years ago scientists wouldn't have even been able to measure them. There's no risk to human health or the quality of the environment."

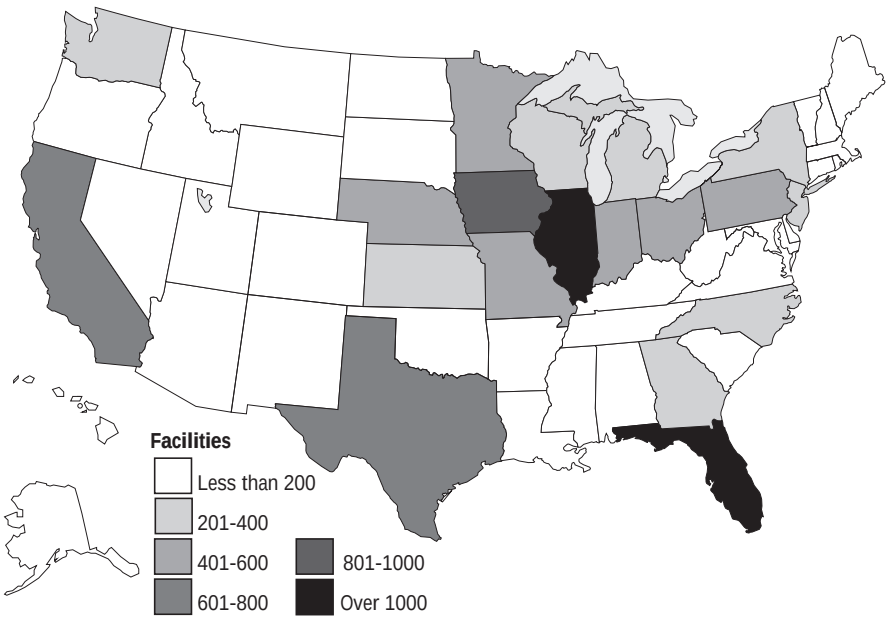
There are many important arguments that can be used to refute this kind of reasoning, but among the most compelling are those involving the hazards of manufacturing and transporting pesticides. Both of these processes expose people and the environment to large concentrated doses of pesticides. Every time you use a pesticide, or eat food that has been grown with pesticides, you're requiring someone or something to be exposed to these hazards.

Nightmarish Disasters

Pesticide manufacturing causes nightmares and jarring headlines when accidents occur. The accidents can be horrifying on a grand scale, as was the infamous 1985 accident at Union Carbide's carbaryl and aldicarb manufacturing plant in Bhopal, India. A toxic cloud of over 60,000 pounds of methyl isocyanate, a chemical used in the manufacturing process, and over 30,000 pounds of other reaction products spread over 15 square miles adjacent to the plant. The area was home to hundreds of thousands of people. Between 2,500 and 5,000 people died and over 200,000 were injured. Doctors did not know how to treat victims who managed to get to hospitals because of the difficulty in knowing just what chemicals were in the toxic mixture. Victims suffered from lung damage, eye injury, suppression of the immune system, chromosome damage, and changes in blood chemistry. Spontaneous abortions, newborn deaths, and birth defects occurred at higher than expected numbers among exposed women and infants.[1]

Caroline Cox is JPR's editor.

Figure 1
Pesticide Manufacturing and Formulating Facilities in the U.S.



Source: U.S. EPA. 1993. Active pesticide producing establishment index. Unpublished list. April 1.

Smaller accidents at pesticide production facilities result in fewer headlines, but also cause nightmares. For example, students in a Middleport, New York elementary school located 400 yards from an FMC Corporation pesticide facility were poisoned in November, 1984 when 50 gallons of methyl isocyanate spilled. The toxic gas was sucked into classrooms by the school's ventilation system; school officials, unprepared for this kind of emergency, took an hour and a half to evacuate the school. Calculations indicate that if it had been twenty degrees warmer outside (typical spring or summer conditions) children could have died from the increased exposure that higher temperatures would have caused. Some of the exposed children suffered permanent lung damage and asthma.[2]

In another frightening example, fiery explosions destroyed a pesticide formulating and storage facility in Cordoba, Mexico on May 15, 1991. Toxic clouds spread over nearby residents, including a school, carrying a mixture of methyl parathion, paraquat, 2,4-D, pentachlorophenol, and unknown combustion products. Five hundred people became ill, and a local water supply was contaminated dur-

ing the firefighting operations.[3]

Routine Hazards of Pesticide Manufacturing

Disasters aside, pesticide manufacturing is not healthy, for workers, production facility neighbors, or the environment. There are almost 12,000 pesticide manufacturing and formulating facilities in the United States.[4] (See Figures 1 and 2) Some are large industrial-scale plants. Others are small, a farm chemicals supplier, for example, or a supplier of swimming pool maintenance chemicals. These facilities formulate, repackage, or dilute chemicals made elsewhere. Regardless of size, there are a number of problems that have been identified often enough to be of widespread concern. The problems include the hazards associated with the materials from which pesticides are made; the health problems experienced by workers in the facilities; the social health problems experienced by the plants' neighbors; and the environmental damage caused by the manufacturing process. Brief introductions to each of these problems follow.

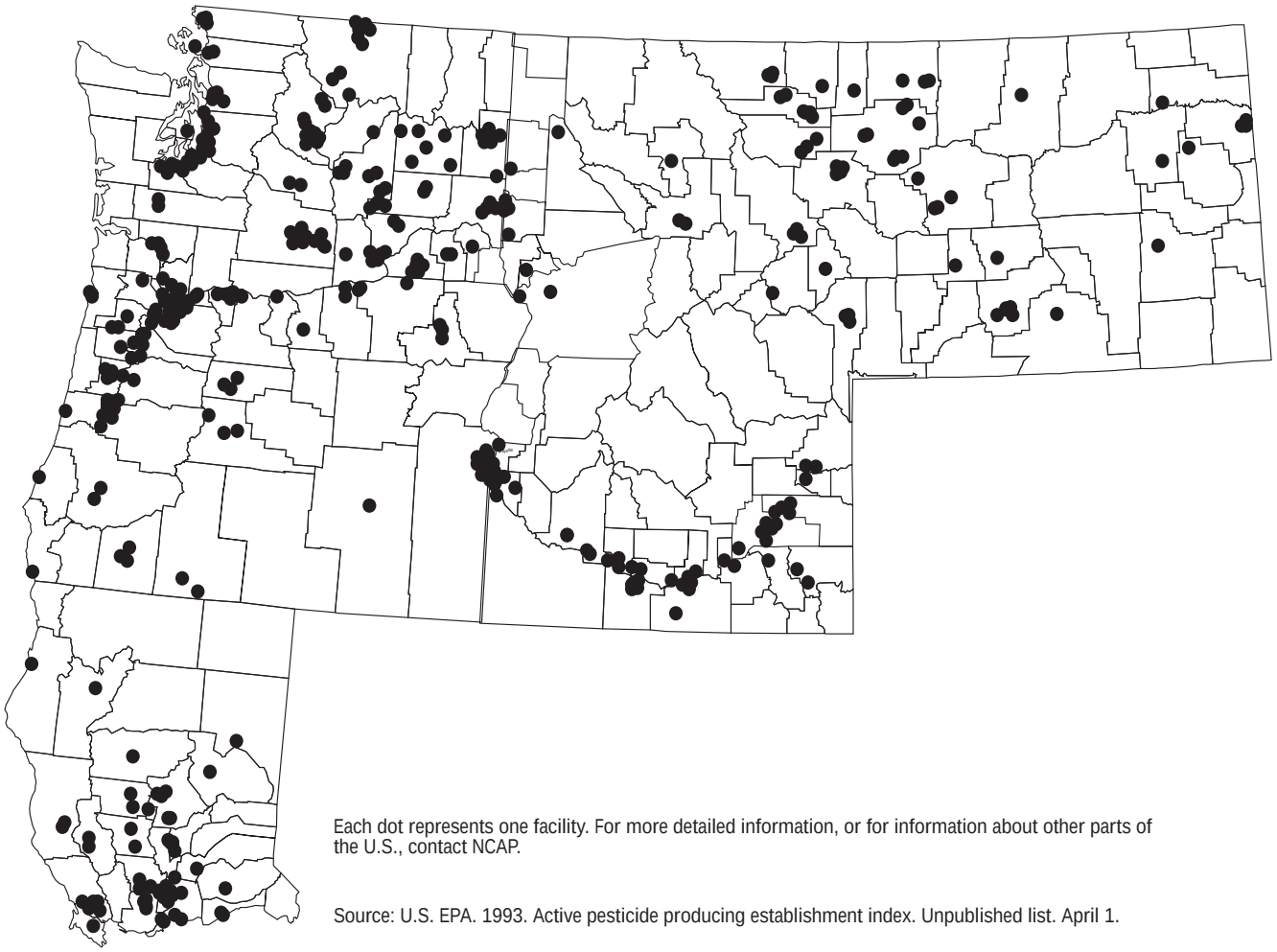
At the Beginning It's Almost Always Oil

Most pesticide products are made from chemicals that are derived from petroleum. Petroleum-based products are also used as a energy source in pesticide manufacturing. Adding these two petroleum uses together, an average of almost a gallon of diesel fuel (or its equivalent) is used in the manufacture of each pound of pesticide,[5] totalling over a billion gallons per year in the U.S.[6] The depletion of this nonrenewable resource must be included as one of the costs of using pesticides.

There are also a variety of environmental costs associated with petroleum production; oil spills are probably the most notorious. Almost 2 billion tons of crude oil are transported by sea every year. Of this, about 400,000 tons is released into the ocean through accidental spills and an even larger amount spills into the seas through routine activities like cleaning tankers. [7]

The cost of cleaning up spills is astronomical, in both economic and ecological terms. An average oil spill costs (based on claims made) about $28,000 per ton of oil spilled. In the case of the infamous Exxon Valdez spill in Alaska's Prince William Sound, costs of claims totalled $90,000 per ton of oil spilled.[8] Ecological damage, of course, is much more difficult to calculate and nearly impossible to repair. For example, 20 years after the tanker S.T. Arrow spilled 16,000 tons of oil off Nova Scotia, much of the oil still remains on shore rocks and sand. Its

Figure 2
Pesticide Manufacturing and Formulating Facilities in the Pacific Northwest



Each dot represents one facility. For more detailed information, or for information about other parts of the U.S., contact NCAP.

Source: U.S. EPA. 1993. Active pesticide producing establishment index. Unpublished list. April 1.

Health Problems of Pesticide Production Workers

NCAP has assembled a number of studies from the published literature which document health hazards to workers in pesticide manufacturing plants. While not intended to be a complete list, the studies do provide an introduction to the kinds of problems faced by those who make pesticides.

Acute Effects: One of the results of workplace exposure to pesticides can be death. In a chilling example, doctors from the University of Utah School of Medicine published reports of five workers who were poisoned in two plants manufacturing the wood preservative pentachlorophenol.[1] Two workers died after working with pentachlorophenol in dusty, poorly ventilated rooms. Although both workers had similar symptoms, in the second case the death was not recorded as an occupational death until years later.

Sensitization to a chemical or groups of chemicals can be another result of acute occupational exposure in a pesticide manufacturing plant. Such problems have been reported since the use of synthetic pesticides expanded after World War II. For example, a worker began packaging organophosphate insecticides, including Phosdrin (mevinphos), in 1956. Following an acute exposure, he noticed that he suffered asthma whenever he was at work. "Any contact with chemicals in the plant, no matter how little, has caused coughing, wheezing and severe dyspnea [difficulty breathing]..." wrote his physician.[2]

Another acute health problem that has been documented in pesticide manufacturing workers is the treatment-resistant skin disease called chloracne.[3] Chloracne has been reported in workers exposed to dioxins and furans, contaminants of several pesticides including pentachlorophenol[4] and 2,4,5-T. It has also been caused by exposure to contaminants in dichloroaniline, used in the production of the herbicides propanil and methazole.[3] One study found that in about 30 percent of workers, chloracne is also associated with the kidney disease porphyria cutanea tarda.[5]

Neurological Problems: Since many insecticides are nerve poisons, neurological symptoms among exposed workers are not unexpected. For example, packers of the synthetic pyrethroid insecticides fenvalerate and deltamethrin developed numbness of their faces along with increased sneezing.[6] Workers manufacturing chlorpyrifos reported more dizziness malaise, and fatigue than did unexposed workers.[7] Workers at a chlordecone (Kepone) manufacturing plant suffered from tremors, weight loss, muscle weakness, incoordination, visual problems, and slurred speech. Some of the tremors persisted for years after the exposure ceased.[8]

Pesticides that are not primarily nerve poisons also cause nerve damage in exposed workers. For example, a study of workers manufacturing phenoxy herbicides showed that exposed workers' nerves did not conduct nerve impulses as fast as nerves of unexposed workers.[9]

Circulatory System Problems: Over twenty years ago, researchers measure an increase in blood pressure in workers exposed to a variety of different pesticides including DDT.[10] Since then, increased risks of other circulatory problems have been associated with pesticide manufacturing. For example, higher than expected risks of diseases that involve the brain's circulatory system were found in workers manufacturing the organochlorine insecticides chlordane and heptachlor for Velsicol Chemical Corporation[11]; workers manufacturing arsenic-based pesticides died of anemia at higher than expected rates[12]; the blood of workers handling nitrophenols, compounds used as intermediaries in the manufacture of the organophosphate insecticides ethyl and methyl parathion,[13] contained two unusual types of hemoglobin, the oxygen-carrying molecule in red blood cells[14]; and over a quarter of the workers in a study of Indian insecticide formulators had electrocardiogram aberrations.[15]

Effects on Reproduction: The most notorious injury to pesticide workers' reproductive potential involves the soil fumigant dibromochloropropane (DBCP), used commonly to kill pest nematodes. In 1977, a study of male workers at a California production facility showed that most of the workers were sterile or had low sperm counts. The sterility was confirmed by at least six studies around the world.[16] Workers most exposed to DBCP appear never to recover their fertility[17,18] and those that do conceive father an abnormally small number of boys.[17]

DBCP is not the only pesticide that has injured the reproductive potential of pesticide workers. The carbamate insecticide carbaryl caused low sperm

A pesticide formulation facility near Eugene, Oregon.

counts and abnormal sperm in male workers.[19,20] The organochlorine insecticide DDT caused chromosome abnormalities in men who worked in production facilities.[21] Chlordecone (Kepone) production workers had low sperm counts and sperm mobility.[22]

Cancer: Cancer risks of pesticide production workers have been hotly debated. This is in part because cancer is an emotional, and often terrifying, subject. Also, epidemiological studies of cancer risks are difficult and slow to show definitive results. However, there is now evidence that pesticide manufacturing causes cancer in exposed workers.

Probably the most notorious cancer risks are those associated with exposure to the pesticide contaminant 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Two 1991 studies linked TCDD exposure to an increased rate of cancer in production workers. The first study included over 5,000 U.S. workers employed by 12 companies manufacturing any of three herbicides, an insecticide, or a bactericide known to be contaminated with TCDD.[23] The second study included over 1500 workers at a German herbicide plant that used processes known to be contaminated with TCDD.[24] The U.S. study found an increased risk from cancer in workers with more than a year of exposure that had occurred over 20 years previously. The increase was significant when compared to the cancer incidence in the U.S. population as a whole. In addition, an almost tenfold increase in the incidence of one cancer, soft tissue sarcoma, was found in the same group of workers.[23] This means that the lifetime risk of death from TCDD-related soft tissue sarcoma is about two deaths per 1000 workers.[25] In the German study, cancer incidence was similarly increased in workers with over 20 years of employment. In addition, women employees had a higher risk of breast cancer.[24]

Pesticide manufacturing processes not known to contain TCDD have also been associated with increased cancer risks for workers. Examples include increased risks of the following cancers: soft tissue sarcoma[26] and non-Hodgkins lymphoma[27] in workers producing phenoxy herbicides; soft tissue sarcoma and lung cancer in workers producing primarily the phenoxy herbicide MCPA[28]; pancreatic cancer in workers producing the organochlorine insecticide DDT[29]; liver cancers in workers producing organochlorine insecticides including aldrin and dieldrin[30]; bladder cancer in workers producing the organochlorine insecticide chlordimeform[31]; lung cancer in workers producing arsenic based pesticides[12]; and bladder cancer in male pesticide production workers.[32]

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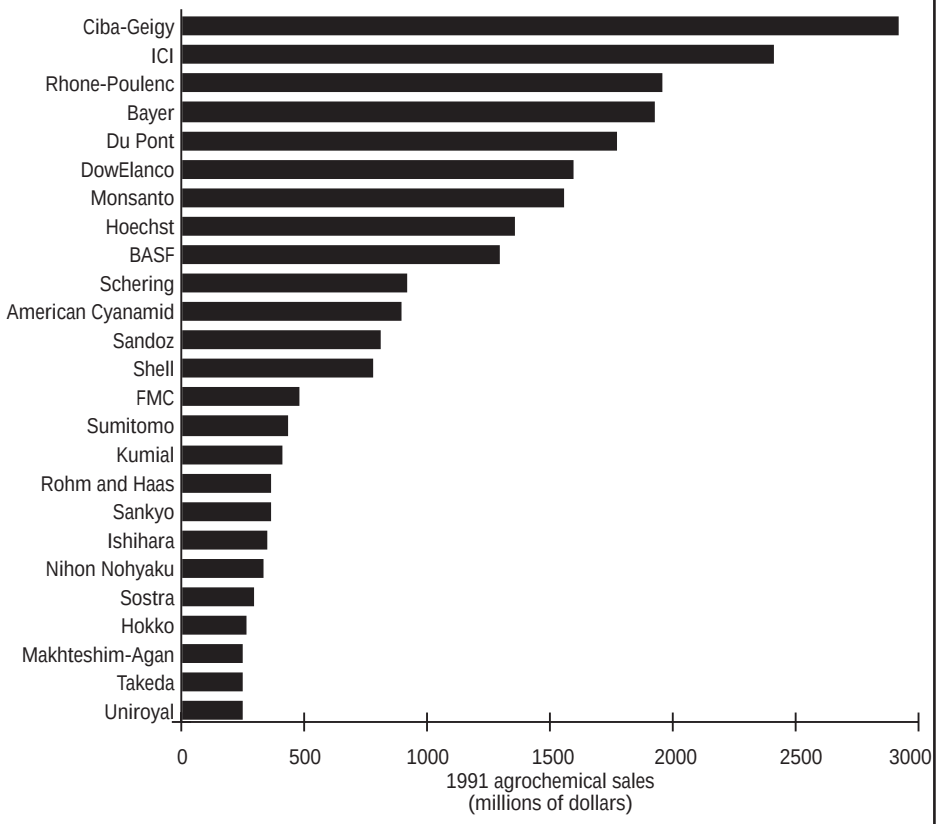
Figure 3
Largest Pesticide Manufacturing Companies



Source: "Consolidation at both ends of top 20 ranking in 1991." *Agrow* #165. August 7, 1992.

biological activity is unknown.[8]

In Prince William Sound, about 18 million dollars were spent trying to rehabilitate sea otters contaminated with crude oil spilled by the Exxon Valdez. This worked out to about $50,000 per otter treated. However, even this enormous investment could not actually repair the damage to otter populations done by the spill. For example, many otters died in spite of treatment, others were released into new territories (outside of oil-contaminated waters) where they suffered "unusually high mortality rates," and others seem to have become infected during rehabilitation with a virulent herpes virus that they then may have transmitted to otters unhurt by the spill.[9]

Large oil spills appear to be becoming more frequent. Five of the world's fifteen largest oil spills have occurred in the 1990s and spills totalled over 700,000 tons per year (enough to fuel every car in California for a day).[10] Pesticide production must take responsibility for a portion of these spills.

Pesticide Production: Not a Healthy Work Environment

Given that pesticides are biologically active compounds, designed to be toxic to at least some living things, it is not surprising that health hazards for the people who manufacture, formulate, and package pesticides exist. Workers are among those at highest risk for any adverse health affects associated with exposure.

It is important to remember that information about these hazards is difficult to obtain. They are difficult for epidemiological studies to document for several reasons. First, there is often a long interval (sometimes decades) between the time when exposure occurs and the time when a disease becomes evident Second, good information about the identity of the chemicals to which a worker has been exposed and how much exposure has occurred is often nonexistent or difficult to obtain. Third, the number of exposed workers is often small, making studies with the statistical power to accurately measure the increased hazard difficult.

In many instances, there are not independent organizations conducting this kind of research; instead, the manufacturers carry out or fund the research. This leads to an obvious potential for conflicts of interest.

In spite of these difficulties, evidence accumulates each year about health problems in pesticide production workers. A wide range of problems have been associated with pesticide manufacturing, including death, asthma, skin diseases, tremors and incoordination, anemia, male infertility, and cancer. See "Health Problems of Pesticide Production Workers," pages 4 and 5, for detailed information.

Neighbors You'd Rather Not Have?

In addition to their effects on the health of their workers, pesticide manufacturing facilities also affect their neighbors. People who live nearby find that their health is compromised, the environment contaminated, and the quality of their lives lowered.

An appalling example is the description of East St. Louis, Illinois given by educator Jonathan Kozol in his 1991 book *Savage Inequalities*.[11] East St. Louis (according to the U.S. Department of Housing and Urban Development) is "the most distressed small city in America." The city "by night and day is clouded by the fumes that pour from vents and smokestacks at the Pfizer and Monsanto chemical plants..." Both Pfizer and Monsanto are chemical manufacturers; Monsanto is the seventh largest pesticide manufacturer in the world, (see Figure 3) and the third largest in the U.S.[11] East St. Louis has one of the highest rates of child asthma in the United States. Within Illinois cities, East St. Louis ranks first in fetal death and premature birth, and third in infant death. The city has had to cancel garbage collection and has lost its city hall to creditors. The school system hires permanent substitutes at low wages instead of regular teachers in order to save money, but still has laid off a large percentage of its staff.[12]

Why does this shortage of cash exist when an expensive pesticide manufacturing facility is nearby? Shouldn't it make a significant contribution to

the property tax revenues that fund many local government and school services? There are many answers to this complex problem, but one of them stands out. According to a reporter from the *St. Louis Post Dispatch*, "The chemical companies do not pay taxes here. They have created small incorporated towns which are self-governed" and provide "tax shelter and immunity from jurisdiction of authorities in East St. Louis."[12]

Similar stories can be told for other pesticide manufacturing plants. For example, at the FMC Corporation facility in Middlepost, New York, an accident (see p. 2) was required to galvanize neighborhood concern about the plant. When concerned residents began to investigate the situation, they discovered a number of problems beyond the accidental methyl isocyanate release. Several times, trees and shrubs in neighborhood yards were damaged and bleached due to what the manufacturer called "permitted releases" of its new herbicide Command (clomazone). Later, residents discovered that the FMC property was also being used as a hazardous waste dump and contained arsenic, lead, solvents, and a variety of pesticides. Extremely high levels of arsenic were measured in the playground of the adjacent school. (JPR 9(1):2-5)

The Broader Picture: Environmental Impacts of Pesticide Manufacturing

The nonhuman neighbors of pesticide plants are also affected by the production process. Consider, for example, Southern California's Santa Monica Bay. It can seem like paradise: sunny skies, glittering blue sea, crashing breakers, white sand, and salt spray. There is of course perspective; the smog's brown haze and the long traffic jams show Los Angeles's well known unpleasant side.

Lurking under the bay's blue waters, however, is another unpleasant fact, and one that gets little public attention. About 200 tons of DDT lie buried in the sediments of the ocean floor, discharged there by sewer lines that carried waste from the Montrose Chemical Company's manufacturing facility. The kelp beds that once flourished have disappeared, white sea bass and pelicans have declined in abundance, and the abundant flatfish Dover sole has suffered from "degenerative fin rot."[13]

The pollution has been the subject of a multimillion dollar lawsuit involving Montrose, the National Oceanic and Atmospheric Administration, the Department of the Interior, EPA, and the Los Angeles County Sanitation District. A consent decree with damages totalling almost 50 million dollars is being proposed.[14]

In a second example, at FMC Corporation's pesticide manufacturing facility in Middleport, New York, state wildlife toxicologists found the facility's waste water lagoon was so contaminated with the insecticide carbofuran and ammonia that birds died within minutes of taking a drink. It is believed that 80,000 birds might have died at the lagoon over a ten year period. (JPR 9(1):2-5)

Many other reports of environmental damage near pesticide production facilities exist. For example:

• Clean up of a phenoxy herbicide manufacturing plant near Hamburg, Germany, required that over 2500 cubic yards of soil (from as deep as 4 yards) be removed and stored as hazardous waste. Six tons of contaminants, mostly chlorobenzenes, was pumped from two of the wells drilled into aquifers under the plant.[15]

• A former employee of Ciba-Geigy Corporation's St. Gabrielle, Louisiana production plant has described over three million pounds of atrazine sitting in waste water treatment ponds near the Mississippi River.

• The organophosphate insecticide dichlofenthion has been found in estuary shellfish near a manufacturing facility and appears to concentrate in both fish and oysters at higher concentrations than it is found in water or estuary sediments.[16]

• Water from the Braan River (in Southern Sweden) downstream of the BT Kemi AB phenoxy herbicide plant caused problems for commercial gardeners who used the water on their crops. Subsequent studies showed that water collected from the river caused root growth of onions to stop and an increase in the frequency of chromosome aberrations in onion cells.[17]

• Arsenic concentrations over 100,000 parts per million (this means arsenic made up about 10 percent of the soil) were found in soils taken from an "inactive industrial site in which agricultural arsenic-base pesticides had been manufactured for over 30 years."[18]

• The neighborhood around Vertac Chemical, Inc.'s Jacksonville, Arkansas manufacturing facility (the plant produced the insecticides DDT, aldrin, and dieldrin, as well as the phenoxy herbicides 2,4-D and 2,4,5-T) has been called "the site of the worst dioxin contamination in the U.S." Residents tell horror stories of cancer and disease.[19] High levels of dioxin contamination have been measured at the site, and also in Jacksonville's sewage treatment facility and in fish caught in local streams. The creek that flows along the western edge of the plant has been quarantined by the Arkansas Department of Health as has the river into which the creek flows. Dioxin has been found in fish as far as 100 miles downstream of the plant.[20]

Waste produced by the plant has been stored on-site since 1987 when the plant closed. About 30,000 drums of dioxin-contaminated waste have been proposed for incineration. The proposal has met with opposition from both local and national environmental organizations for a variety of reasons. One of the most telling, perhaps, is that the incineration will not get rid of the toxic waste. Burning waste for about a year processed almost 10,000 drums of waste, but generated almost 14,000 drums of salt and ash contaminated with enough dioxin that they are classified a hazardous waste.[21]

Taken together, these examples paint a disturbing picture of the environmental costs of pesticide manufacture.

Transporting Pesticides

The unfortunate consequences of transporting large quantities of toxic pesticides between manufacturing plants, formulating facilities, and users was clearly demonstrated to Northwest residents in 1991 when almost 20,000 gallons of the carbamate soil fumigant metam sodium spilled from a derailed freight train into the Sacramento River near Dunsmuir, California.[22,23] The chemical, manufactured in California and headed for Columbia Basin potato fields,[24] produces the highly toxic chemical methylisothiocyanate when exposed to water.[25]

Fish, ducks, otters, insects, and all living things were killed along a forty-five mile stretch of the river.[25] The river's trout fishery had been world-renowned prior to the spill.[26]

Residents of Dunsmuir breathed fumes from the spill overnight before they were notified officially that the chemical was poisonous and some suffered ill effects for months.[27,28] The California Department of Health Services has found that miscarriage rates among Dunsmuir residents were twice the normal rate following the spill. Some of these miscarriages are as yet unconfirmed by investigators.[29]

Investigations after the spill uncovered numerous problems that combined to cause the accident. The pesticide was being transported in an old model of tank car, not usually thought to be adequate for hazardous materials, and the metam sodium was not identified as a hazardous material by either the railroad or the U.S. Department of Transportation.[26]

We live with the potential for these kinds of spills every day. More than one billion pounds of pesticides are used in the U.S. every year[6] and almost every pound must be transported before it is used. While they don't have the enormous scale of the Dunsmuir spill, spills occur on a daily basis. The U.S. Department of Transportation's database of hazardous materials spill reports has documented between eighty and a hundred spills a year for the past three years.[30] (See Figure 4). These represent a small proportion of the total number of pesticide spills because only about 60 percent of spills that should be reported to the database actually are reported, and the many spills that occur from carriers (trucks, trains, and boats) without an interstate license have no reporting requirement.[31]

Spills of hazardous materials recorded in the database have been occurring with increasing frequency. A recent study by the *Los Angeles Times* showed that the number reported spills each year increased by 37 percent in the decade between 1982 and 1991. No such study has been done for pesticide spills specifically.[32]

Several special concerns about spills are important to consider. Pesticide spills are accidents, and firefighters or other emergency response personnel are often called to the scene. They are frequently faced with an unknown mixture of toxic or potentially toxic substances and careful management of the spill can be difficult. For example, consider the truck and triple trailer that swerved into a guardrail along Oregon's Interstate 5 freeway in June, 1985. It overturned, exploded, and burst into flames. Local firefighters had no idea what was in the truck and several firefighters had to be treated for chemical burns after working to put out the fire. Later on, the trucking company provided information about what was in the truck. Its cargo included the organophosphate insecticide diazinon, paint, cleaning compounds, and gunpowder. The explosion hurling these substances together produced many unknown compounds. Eventually more than 300 emergency workers were on the scene, and the freeway was closed for 15 hours.[33]

Mary Rounds

Even if the identity of the spilled pesticide is known, these accidents can still pose hazards to emergency responders. In 1973, a truck carrying the soil fumigant 1,3-dichloropropene jackknifed in urban southern California. The accident was cleaned up by firemen who washed the chemical into storm drains. The truck was carrying only the fumigant, and no other compounds were known to be produced during the accident. However, two of the seven firefighters subsequently died from lymphoma; one at age 40 and the other at age 33.[34]

There are also dangers from pesticide spills to bystanders or nearby residents. There often is no opportunity for those who happen to be in the immediate area to be warned about the identity or toxicity of the spilled pesticide. Neither is there any opportunity for bystanders to protect themselves from exposure. Serious health consequences can result.

For example, Australian physicians reported in 1985 about two the deaths from leukemia of two patients. The street in front of the patients' house had been the scene of a tanker truck accident in 1969. The truck, filled with the organophosphate insecticide mevinphos, exploded and some of its contents were splashed on the front yard and veranda of the patients' house. The neighborhood was evacu-

ated and six people were hospitalized. Six years later, the husband was diagnosed with leukemia and died within a year. The wife developed leukemia in 1982 and died shortly thereafter.[35]

Clearly, it is not possible to establish cause-and-effect associations based on these case reports, but they do illustrate the special hazards potentially posed by transporting pesticides.

Taking Action

The stories and studies surveyed in this article are, to be blunt, gruesome. Hopefully though, they are more than that. They are meant to serve as a catalyst for action. What is the next step we can take? How can we reduce the hazards posed by the manufacture and transport of pesticides?

The most important and most effective solution is to reduce or eliminate the use of these toxic substances. While this is obviously a long-range goal, it is becoming increasingly possible all the time. As concerns about the health, environmental, and economic costs of using pesticides grows, alternative pest management strategies are becoming more effective and are used more widely.

Even those who might be thought to be strong advocates of chemical-intensive pest management agree. For example, the American Farm Bureau Federation's president Dean Kleckner told the Southern Agribusiness Forum recently that "cotton farmers have cut pesticide use from 78 million pounds a year to less than 19 million pounds over the past 30 years and yields have gone up 13 percent for the past ten years.... Other crops tell a similar story. Corn, rice, soybeans and wheat all show significant decreases in the use of herbicides and insecticides while yields have increased..."[36]

Work to reduce pesticide use needs to consider how such reductions will affect the people who now work in pesticide manufacture and transport. While these jobs may be hazardous, they often offer family-wage employment at a time when such jobs are becoming hard to find. In theory, pesticide alternatives offer similarly high-paying work as pest management consultants, but making this switch may be difficult in practice. The Oil, Chemical and Atomic Workers International Union has proposed a way to bridge this gap.[37]

Reducing pesticide use is, however, an enormous undertaking. Are there interim steps we can take? The answer is yes. Some of the most interesting involve neighbors and workers working directly with manufacturers (good neighbor agreements), requiring public disclosure of potential hazards (community right-to know), and establishing legislative and regulatory mandates that force manufacturers to pay the social and environmental costs of their products (registration fees and other taxes).

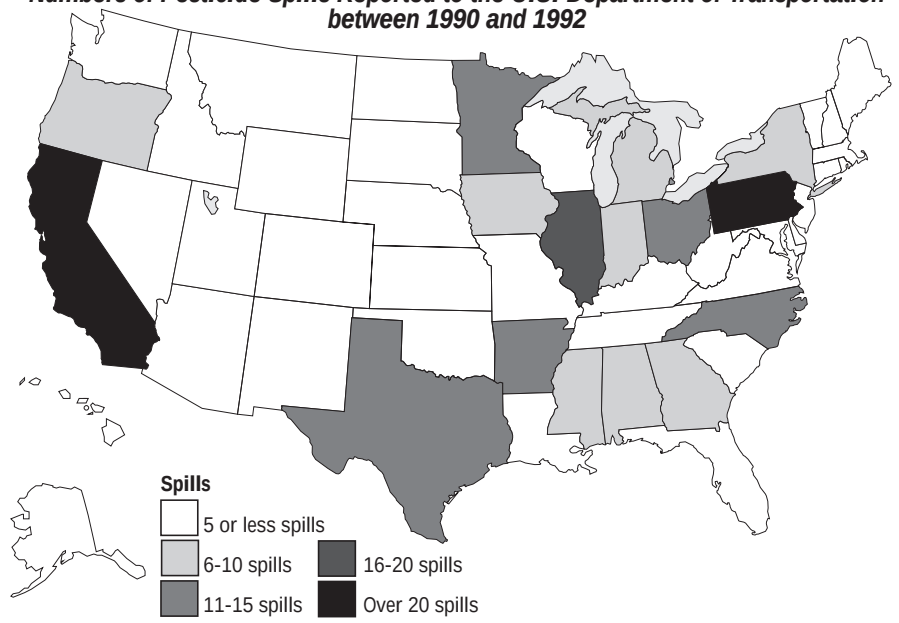
• **Good Neighbor Agreements**: These agreements among residents near a manufacturing facility, workers, and a manufacturer can require reductions in the use and disposal of toxic chemicals, allow residents and workers to inspect plants for safety and environmental problems, and provide neighbors and workers the right to participate in oversight committees.[38]

While this is a new strategy, several important agreements have been made. For example, in 1992 a chemical spill at a Rhone-Poulenc facility near Houston, Texas sent 27 workers to the hospital. Workers asked the environmental group Texans United for help. Together they were able to become an official part of negotiations for amendments to the plant's permit with the Texas Water Commission that allows operation of a hazardous waste incinerator. The negotiations resulted in a legally binding document that is part of the permit that requires Rhone-Poulenc to pay for an environmental and safety audit conducted by an expert chosen by community residents. It also requires the company to make public its modelling of accident scenarios, and to fund a health study, air monitoring, and water sampling in the neighboring community.[39]

• **Community Right to Know:** The right-to-know laws passed by the federal government during the 1980s have been a powerful tool for protecting human and environmental health from the hazards posed by pesticide manufacturing. They have allowed citizens to knowledgeably participate in environmental protection and have allowed workers to participate meaningfully in programs to reduce workplace hazards. Journalists, legislators, emergency planners, industry environmental managers, and regulators have all made positive use of the information made accessible by right-to-know laws.[40]

Right-to-know laws need strengthening, however. They need to include more chemicals, and a clearer mandate to prevent pollution and chemical accidents.[69] Neighbors and workers need the right-to-act to prevent hazardous situations and the right-to-know more information about the potential hazards. Federal legislation of this kind

Figure 4
Numbers of Pesticide Spills Reported to the U.S. Department of Transportation between 1990 and 1992



Source: U.S. Dept. of Transportation. Hazardous Materials Safety. Hazardous Materials Information System. 1993. Hazmat summary by state for calendar year 1990, 1991, and 1992: Incidents involving transportation of pesticides. Unpublished report. (May 4.)

has been introduced, as has some state legislation.[41]

• **Registration Fees and Taxes**: Pesticide manufacturers need to pay the full cost of producing, using, and disposing of their products without being given either economic or environmental subsidies. The fees manufacturers presently pay to register pesticide products do not even cover the costs of registration, and certainly do not begin to pay for their environmental costs. Taxpayer support is required to pay for the registration process.[42] Fees need to be increased to pay first for registration, then for the full range of other costs associated with pesticide use. This should bring about a direct reduction in pesticide use as nonchemical alternatives become financially advantageous.[43]

Given the many failures of the process that is supposed to regulate pesticide use, clear financial incentives to use alternatives have appeal. This idea has even supported by pesticide manufacturers: DowElanco's chief executive officer Frank Popoff has testified before Congress that the full life cycle cost of a product should be "incorporated into the price consumers are charged."[44]

So think about how pesticides are made and shipped next time you hear that "a few parts per million is like a second out of ten days. How could that possibly be a problem?" Remember that those few parts per million that are left on your food, your water, or your air are just the end of a long process that has the potential to create disastrous accidents, consumes nonrenewable resources, is unhealthy for workers and neighbors, and leaves behind a legacy of contamination. It's a situation that is ripe for change. ■

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