

EPA Halts Most Use of Herbicide 2,4,5-T

Study finds miscarriages occurred among Oregon women just after the spraying period there

Citing a new link between exposure to a dioxin and an increased risk of miscarriages, the Environmental Protection Agency (EPA) has temporarily halted most uses of two common herbicides that are unavoidably contaminated by the dioxin. The herbicides are 2,4,5-T and silvex, which are widely used to control weeds and underbrush in areas ranging from lawns and golf courses to highway median strips and forests. The dioxin suspected of causing miscarriages in women is TCDD, a contaminant of the notorious Agent Orange defoliant used in Vietnam and of the chemical cloud that descended on Seveso, Italy, after an explosion there in 1976.

TCDD dioxin has long been one of the most toxic substances known, but the study that the EPA action was based on presents the first tangible proof of its serious toxicity in humans. The study found a significant increase in the number of miscarriages among women in Alsea, Oregon, an area where large quantities of 2,4,5-T have been sprayed by helicopters in order to increase the production and efficiency of commercial forests. EPA began the study after 8 women from the area wrote to the agency last year to report they had 13 miscarriages among them since 1973. The results of the study, completed in January, demonstrate not only an increased number of miscarriages throughout the spraying area, but also that most of the miscarriages occurred in the months of June and July, just after the peak spraying period of March and April.

"I'm very happy," says Bonnie Hill, the 33-year-old English teacher in Alsea who uncovered the apparent link and wrote to the EPA 2 years after her own miscarriage. "The EPA has done the only sensible, reasonable thing it could," she told *Science*. Mrs. Hill, who also teaches journalism and coaches girls' basketball, began to suspect a link between the spraying and her miscarriage last summer. In a course at the University of Oregon, she learned that 2,4,5-T and its dioxin contaminant had caused birth defects and other problems among monkeys in tests at the University of Wisconsin. "None of us was thinking

about herbicides at the time of our miscarriages," she says. "But when I discovered that it had had these effects, and then learned that the U.S. Forest Service and the Bureau of Land Management had sprayed very extensively in the Alsea area, I started talking to my neighbors and former students." The area she lives in, on Oregon's western coast, has a population of only a few thousand people, enabling her easily to put together the connection that had eluded the federal government for so long. Modestly, she insists that she and the other seven women who wrote to the EPA "do not deserve singling out. This is not an isolated situation, and Alsea is not the only area where the spraying has occurred and women might be exposed."

EPA officials agree. They invoked emergency suspension powers to halt the spraying nationwide just as the spring season was about to begin. EPA Deputy Administrator Barbara Blum estimates that 7 million pounds of 2,4,5-T were about to be sprayed on forests, pastures,

He adds that "the bulk of the scientific data gathered to date over three decades of use demonstrate that there has never been a single documented incident of human injury resulting from normal agricultural use of these products."

Taken literally, the assertion appears to be in accord with the statements of EPA officials. The only two agricultural uses, on rice fields and on rangelands grazed by cattle, were exempted from the suspension because human exposures are lower there. As a result, the ban applies to 74 percent of the use of 2,4,5-T and to 67 percent of the use of silvex. "There is no imminent hazard to humans in these [exempted] circumstances," Blum says. Her statement was contested by the Environmental Defense Fund, which has petitioned EPA to ban all uses of silvex and 2,4,5-T. Representatives of the group were present at the EPA announcement on 1 March.

The EPA action follows years of research into the toxicity of TCDD (2,3,7,8-tetrachlorodibenzo-*p*-dioxin), and a pleth-

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and power line or highway rights-of-way. An estimated 4 million people would have been at risk, she says. Combined with the Alsea study results, "these facts sound an alarm. They compel EPA to act to stop use until we have a fuller understanding of this phenomenon and its implications for human health."

Though the suspension takes effect immediately, it still must be upheld at a formal hearing to occur within the next few months. Dow Chemical Company, the principal manufacturer of 2,4,5-T and the chemical components of silvex, has announced its intention to challenge the suspension and get it tossed out by a court. E. H. Blair, Dow's director of health and environmental sciences, says dramatically that "This is an example of government at its worst—basing a hasty product suspension on data which have not been subjected to scientific review."

ora of findings that link it with miscarriages, birth defects, and tumors in test animals. EPA did not ban the herbicides that contain TCDD earlier because, until the latest study, no lasting or serious effects had been found in humans. TCDD dioxin has apparently never been found in human tissues, for example. It has been found in a few samples of beef fat and human mothers' milk, but never in quantities or with a frequency of statistical significance. Investigations of its toxicity have persisted because it remains potent at the lowest dose tested in animals (10 ppt), and suspicions remain that the same or ever lower doses might be toxic in man.

Even in the Alsea study, the EPA and its contractors at Harvard University and elsewhere were unable to conclusively establish that the women who suffered miscarriages carry TCDD in their

bodies. The link remains one of apparent cause and certain effect, absent the means of transmission. Blum says that it may have been inhalation, absorption through the skin, or ingestion with food or water. Helicopter spraying is known to permit the herbicides to drift greatly, potentially accounting for exposures among women removed from the areas of direct spraying. And the epidemiology reveals the beginning of a dose-response curve. Without the smoking gun, however, "we are not saying that the health effects in humans are positively proven, or that 2,4,5-T should never be used again," Blum says. "What we are saying is that there is sufficient evidence to stop further exposure to the chemical until the issues can be resolved."

The EPA is just now beginning to analyze more rigorously samples of soil, water, deer and elk meat, and human mothers' milk from Alsea. If TCDD dioxin turns up in any of them, EPA will have little difficulty upholding the suspension and perhaps banning the herbicides forever. Asked why this information was not gathered in advance of the suspension, an EPA official explained that "we have only limited resources and personnel." Matthew Meselson, a researcher at Harvard and a consultant to the EPA on dioxins, says that "if the EPA had assigned a higher priority to this, the data could have been gathered much faster. If I had been responsible, I would have handled it differently." There have been major technical obstacles to overcome, however, such as the difficulty of detecting the herbicide in very small quantities.

Even without definite proof of the means of exposure among the Oregon women, the new study—performed by scientists at the Environmental Health Institute at Colorado State University and the University of Miami Medical School—represents an important breakthrough. It comes on the heels of a preliminary rejection by EPA of Dow's contention that TCDD and other dioxins are present naturally in the environment and that combustion, not pesticides, are responsible for dioxin contamination near Dow's plant in Midland, Michigan (*Science*, 15 December 1978). "No information, other than purely circumstantial evidence, has been submitted by Dow to support the premise that dioxins are typical by-products of combustion," the EPA says. Taken together, the various EPA findings suggest a strong federal case against the herbicides, which until recently, were freely used by various federal agencies. The tables have definitely turned.—JEFFREY SMITH

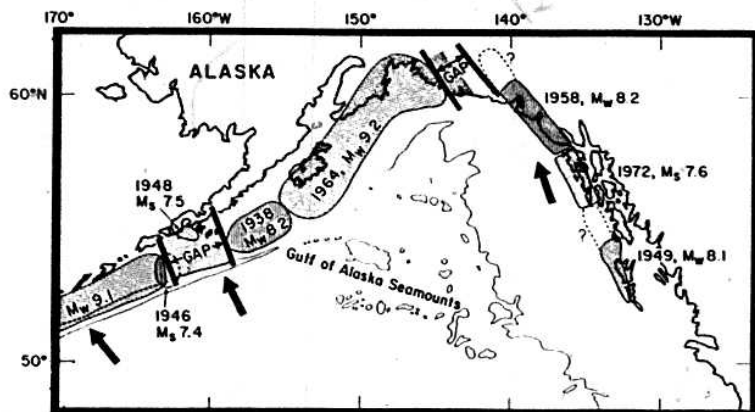
Another Successful Quake Forecast

A large earthquake struck the sparsely populated Alaska coast on 28 February. Residents who felt the shock were taken by surprise, but many scientists were expecting the quake. The quake is thought to be the second in 4 months that seismologists anticipated on the basis of careful reading of historical records of earthquakes and a basic understanding of crustal plate motions. The other occurred near Oaxaca, Mexico, last November (*Science*, 2 March, p. 860). Although not true predictions—a prediction being the relatively precise time, location, and magnitude of a future event—the forecasting of the location of large (magnitude greater than 7) earthquakes is seen as a significant step in the right direction. Now, some researchers are holding their breath because the last destructive seismic activity in the area of February's quake was a series of four large earthquakes, the second and third coming only 6 days after the first.

The Alaskan earthquake, which had a magnitude between 7.5 and 8.0 and was located 400 kilometers east of Anchorage, appears to have occurred in a previously identified seismic gap, a normally active seismic zone that has not experienced a large earthquake in 30 years or more, according to William McCann of Lamont-Doherty Geological Observatory. This Gulf of Alaska gap, which extends about 320 kilometers along the coast, was first identified in 1971 by John Kelleher of the Nuclear Regulatory Commission, Lynn Sykes of Lamont-Doherty, and Jack Oliver of Cornell University. They noted that several segments of the Alaska-Aleutian seismic zone qualified as gaps, and hence large earthquakes might be expected to strike within the gaps in the next few decades. A quake promptly filled one of those gaps in 1972 along the southeastern coast of Alaska (see figure).

Kelleher's group considered the Gulf of Alaska gap to have a high risk because no large earthquake had released the stress in that area since at least the turn of the century, but the risk was uncertain because the historical records are sketchy. Also, the plate boundary is very complex in the area, where the seismic zone makes a 90° turn. Four large earthquakes in the general vicinity of the gap may have released stress in part or all of the gap in 1899 and 1900. McCann believes that the recent quake released stress within the gap, but only in the eastern portion of it. Since the release of stress in one segment of a seismic zone can place additional strain on the adjacent segment, large earthquakes sometimes occur in closely spaced pairs or groups, as happened in 1899–1900. McCann has identified a period of quiescence (an absence of moderate quakes) within the Alaska Gulf gap similar to the quiescence that preceded the Oaxaca quake. This quiescence, the grouping of quakes in 1899–1900, and the geologic structure of the area have convinced McCann that the possibility of another large quake in the remainder of the gap, which extends almost to Valdez, is very real.

—RICHARD A. KERR



Part of the Alaska-Aleutian seismic zone. The seismic gap marked at the top by the heavy bars was noted in 1971. The earthquake on 28 February appears to have ruptured only the eastern half of the gap, leaving the shaded area intact, according to William McCann of Lamont-Doherty Geological Observatory.