



Dow Chemical vs. 'Coercive Utopians': Constructing the Contested Ground of Science and Government Regulation in 1970s America

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In 1979, the Dow Chemical Company published an excerpt from a speech by H. Peter Metzger that announced an emerging conflict in American ideals and public policy. He stated that a new kind of individual inhabited Washington, people from the counterculture who were "coercive utopians" because they sought to achieve their agenda through covert actions and hoped to end the American free market economy. Following the 1962 publication of Rachel Carson's *Silent Spring* and the subsequent banning of DDT in 1972, Dow and other chemical manufacturers fought to keep the regulatory climate favorable to industry. Dow found itself defending the phenoxy herbicide 2,4,5-T in particular for almost the entire decade of the 1970s. Using Dow Chemical Company records, trial transcripts, scientific journals, and writings by environmental activists, it becomes possible to see the contested landscape of scientific knowledge and chemical regulation. This essay argues that Metzger's "coercive utopians" challenged the assumed scientific basis of chemical safety and used the regulatory powers of the state to reassess the safety of everyday chemicals. This established a pattern of contested knowledge and ideological conflict that continues to form the core of debate between public safety and free-market prerogative.

"The environmentalists have had the biggest victories: Ranking jobs . . . have gone to men and women who have . . . lobbied . . . for conservation, protection of wildlife and clear air and water."¹ With these words, social

¹ "The Point Is . . . : A Summary of Public Issues Important to the Dow Chemical Company," no. 8, 21 Dec. 1979, folder 6471, box 215, series IX, "Media Response," unprocessed, Alvin L. Young Collection on Agent Orange, National Agricultural Library, Beltsville, Md., hereafter cited as the Young Collection.

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critic H. Peter Metzger observed the kind of people populating Washington, D.C., and various government agencies under the Jimmy Carter administration. He went on to distinguish such individuals as different from the usual political appointees, the beneficiaries of the routine spoils system. These members of the counterculture, he warned, wanted to do more than simply enjoy political patronage; they wanted to dismantle the basic mechanisms for generating wealth in the country. These “coercive utopians,” as Metzger labeled them, sought to achieve their goals covertly. Those goals included a reduction in per capita energy consumption, a shift from fossil fuels to solar energy, and an undetermined form of economy that bore no relation to capitalism or private ownership. Metzger’s warning appeared in a 1979 Dow Chemical Company brochure and revealed the growing concern the chemical industry in general, and Dow in particular, held toward the new regulatory climate that had emerged in Washington during the 1970s. For Dow and corporations like it, new legislation like the 1969 National Environmental Policy Act (NEPA), newly created agencies like the Environmental Protection Agency (EPA), and new advisory bodies like the president’s Council on Environmental Quality (CEQ) all heralded a new regime of public interest that would “strangle” society through regulation, review, and repeal of existing and potential chemical licenses and legislation. During the decade of the 1970s, from the banning of DDT in 1972 through the controversy over the herbicide 2,4,5-T and its associated dioxin contaminant at the end of the decade, Dow would fight these “coercive utopians” and their vision of a government more responsive to the health and ecological concerns of ordinary Americans. This established a pattern of contested knowledge and ideological conflict that continues to form the core of debate between public safety and free-market prerogative.

The Dow Chemical Company ranked as the second most profitable industrial chemical producer in the United States in 1993, with revenues of \$12.5 billion, behind only DuPont’s \$15.6 billion in revenue.² Founder Herbert Dow located the company in Midland, Michigan, and the company grew in tandem with the twentieth century. It started as a major supplier of chlorine-based bleaching powder and caustic soda produced through an electrolytic process. The company began making sodium chloride, which initially was used to produce synthetic chloroform, and later used to make magnesium and calcium chloride. Chloroform manufacture generated carbon tetrachloride, a major component of agricultural chemicals and pesticides.

Dow entered the field of petrochemicals in the 1930s. This decade saw the development of two major chemical products, Styron and vinylidene chloride, which in turn were the basis of Styrofoam and Saran. These products meant that Dow’s major profits came from supplying the

² Alfred D. Chandler, Jr., *Shaping the Industrial Century: The Remarkable Story of the Evolution of the Modern Chemical and Pharmaceutical Industries* (Cambridge, Mass., 2005), 13.

ingredients for household items like plastic wrap and cleaners. Agricultural chemicals represented a small portion of the company's product profile.³

Financially, the 1970s were for chemical companies, in the words of business historian Alfred D. Chandler, Jr., a "turbulent decade."⁴ The Organization of Petroleum Exporting Countries (OPEC) successfully raised the price of a barrel of crude oil from \$2 to almost \$30. The economy more broadly suffered from stagnation, and for some, the increased scrutiny of chemical regulations endangered popular products. Dow, along with other chemical manufacturers, had acquired the right to produce 2,4-D and 2,4,5-T at the end of the Second World War. Initially researched as plant growth regulators, the phenoxy herbicides represented a major component of the U.S. development of biological weapons during the 1940s through a partnership between university and military scientists. Their use as biological weapons came about with the realization that these hormone-like substances could be used to kill plants through an acceleration of growth. The commercial application of these plant growth inhibitors as effective plant herbicides had begun almost before the war had ended.⁵ Along with the organochlorine insecticide DDT, synthetic fertilizers, and new farm equipment, the phenoxy herbicides represented one of the major discoveries with agricultural applications made during World War II.⁶ Legal maneuvering stripped American Chemical's patent rights to the herbicides, and the major chemical companies shared production of the herbicides after the war.⁷ Although they were not a major part of Dow's chemical product line, commercial herbicides generated significant revenue, growing to over 70,000 acres treated with herbicides for total expenditures of \$270,750,000 in 1962.⁸

One other important episode needs to be discussed before examining the 1970s and Dow's battles against the "coercive utopians" in more detail. As part of a larger pattern of student protest against the Vietnam War, described in one contemporary account as "unrestrained anarchy," Dow Chemical became a nationally recognized name because of its manufacture of a military weapon, napalm B.⁹ Napalm, essentially jellied gasoline in its

³ Chandler, *Shaping the Industrial Century*, 55-56.

⁴ *Ibid.*, 28.

⁵ Gale E. Peterson, "The Discovery and Development of 2,4-D," *Agricultural History* 41 (July 1967): 244-48.

⁶ Nicholas Rasmussen, "Plant Hormones in War and Peace: Science, Industry, and Government in the Development of Herbicides in 1940s America," *Isis* 92 (June 2001): 294.

⁷ Rasmussen, "Plant Hormones in War and Peace," 308, 309.

⁸ Peterson, "Discovery and Development," 243.

⁹ Philip Boffey, "Campus Unrest: Riots Bring Danger of Punitive Backlash," *Science*, n.s., 164 (11 April 1969): 165; Patrick D. Kennedy, "Reactions against the Vietnam War and Military-Related Targets on Campus: The University of Illinois

modern form, had many previous incarnations in warfare dating back to Greek fire. U.S. military leaders argued for its use in South Vietnam because of the entrenched nature of enemy troops. In 1966, Dow was the second biggest contractor for napalm after United Technology Center, which had begun to experience protests against their production of napalm at their Redwood City, California, plant.¹⁰ After 1966, during the escalation of the Vietnam War and protests against it, Dow Chemical became the only producer of napalm B after the other chemical manufacturers discontinued production in response to anti-war protests. The first demonstrations against Dow occurred at its New York City headquarters, where demonstrators marched and urged the boycotting of Saran Wrap. The company responded by noting that it supported the right of all Americans to non-violent, legal protest. The official statement went on to give the company's position: "Our position on the manufacture of napalm is that we are a supplier of goods to the Defense Department and not a policy maker. . . . Simple good citizenship requires that we supply our government and our military with those goods which they feel they need. . . ."¹¹ The decision thrust Dow into the national spotlight, as antiwar demonstrations spread to college campuses across the country, and Dow recruiters became prime targets.

While initially student protests had focused on Dow's Midland headquarters, the first campus protests took place at Wayne State University in Detroit during Dow's 1966 recruiting campaign. Military and Central Intelligence Agency (CIA) recruitment moved off-campus, preventing students from disrupting their recruitment activities. Dow, confident of their ethical stance, remained on campus. As antiwar sentiments intensified, so too did the Dow campus protests.¹² There were over 133 campus incidents in 1967, beginning with a violent demonstration at Los Angeles State College. Recruiters were taken to another building after demonstrators flooded the original site. The men escaped a student mob through a back window, fought their way to their car, and eventually were able to drive the car away. Perhaps the most visible violence broke out later that year at the University of Wisconsin's Madison campus, after the Dow recruiter was prevented from leaving the building by over two hundred student protesters. When student demonstrators refused to leave the building, campus security called in local police. Sixty-five people were injured, including three policemen; nine students were

as a Case Study, 1965-1972," *Illinois Historical Journal* 84 (Summer 1991): 101-18.

¹⁰ Lawrence E. Davies, "Napalm Foes Petition for Vote to Bar Factory in Coast City," *New York Times*, 17 April 1967, p. 8; E. N. Brandt, *Growth Company: Dow Chemical's First Century* (East Lansing, Mich., 1997), 352, 353.

¹¹ Brandt, *Growth Company*, 353.

¹² *Ibid.*, 354, 355.

arrested, and police used tear gas to disburse the protesters.¹³ Following a protest at Harvard on October 26, Dow officials declared they would ignore campus protests and continue their recruitment efforts.¹⁴ Later that year, Dow chairman Carl Gerstacker admitted that the protests had hurt Dow; consumers were urged to boycott its products and divest its stocks, and the company had to devote considerable time addressing the problem. He again asserted, however, Dow's commitment to supplying "American soldiers in Vietnam" the weapons they needed to fight the war.¹⁵ Dow received public support from the president of IBM, who challenged protesters' demands that Dow quit manufacturing napalm and pointed out that almost all companies were contributing to the war in Vietnam.¹⁶ From 1966 through the end of 1967, Dow recruiters experienced five hundred demonstrations on three hundred college campuses. Although the protests appeared not to have damaged Dow's recruitment efforts, and the company itself boasted of its successful resistance to antiwar pressure even after it quit producing napalm, the years 1966 to 1969 saw the company engaged in a national battle against what one company insider called the "Flower Children" over one of its products.¹⁷

In 1970 came an embarrassing admission from Dow vice-president Julius Johnson, testifying before a House Subcommittee on the "Effects of 2,4,5-T on Man and the Environment," chaired by Michigan Senator Philip Hart. Johnson testified that samples of 2,4,5-T submitted for analysis by Bionetics Research Laboratories in 1964 contained significant amounts of a contaminant commonly known as dioxin, a highly toxic substance. In his testimony, Johnson argued that current testing measures had identified high levels of dioxin in the 2,4,5-T herbicide produced by the company in 1964, and that current production had decreased dioxin contamination to trace levels. He recommended a review of communications and protocol even as he urged that regulatory decisions over matters of science continue to be based on scientific evidence and expertise.¹⁸ Ten years later, Dr.

¹³ C. Gerald Fraser, "Antiwar Protest Ends in Violence," *New York Times*, 19 Oct. 1967, p. 8; Brandt, *Growth Company*, 355, 356.

¹⁴ "Harvard Protest Delays Dow Aide," *New York Times*, 26 Oct. 1967, p. 7; Gerd Wilcke, "Dow Will Ignore Campus Protests," *New York Times*, 27 Oct. 1967, p. 6.

¹⁵ "Dow Chief Says Protests Hurt," *New York Times*, 18 Nov. 1967, p. 14.

¹⁶ "Napalm—A Useful but not a Pretty Weapon," *New York Times*, 20 Dec. 1967, p. 247.

¹⁷ Anthony Ripley, "Napalm Protests Worrying Dow, though Company Is Unhurt," *New York Times*, 11 Dec. 1967, p. 2; Robert J. Cole, "'Keep your cool,' Dow Advises Targets of Antiwar Protesters," *New York Times*, 4 June 1970, p. 59; Brandt, *Growth Company*, 351-62.

¹⁸ Julius E. Johnson, "Statement of Dr. Julius E. Johnson, Vice President, Dow Chemical Company, April 7 and 15, 1970," *Hearings Before the Subcommittee on Energy, Natural Resources, and the Environment of the Committee on Commerce; United States Senate, Ninety-First Congress, Second Session on*

Samuel Epstein, a vocal critic of U.S. chemical regulatory policy, would charge that Dow had knowingly withheld information about the toxicity of the 2,4,5-T produced for the manufacture of Agent Orange herbicides used during the war from 1964 until 1970.¹⁹ Dow spent the decade defending its phenoxy herbicides in general, and 2,4,5-T in particular. Three key events put the company on the defensive: the production and use of Agent Orange herbicides as a chemical defoliant during the Vietnam War; the 1970 creation of the Environmental Protection Agency (EPA) and transfer of chemical regulation to that agency from the Department of Agriculture (USDA); and the 1972 banning of the insecticide DDT.

When efforts to use fires to clear jungle growth in South Vietnam failed, the phenoxy herbicides once again drew military interest. What would eventually be called Operation Ranch Hand gained Secretary of Defense Robert McNamara's support in 1961, and defoliation operations began in January 1962, the same year *Silent Spring* was published. Over the next ten years the United States released approximately eleven million gallons of an equal measure of 2,4,5-T and 2,4-D, which came to be known as Agent Orange, over the South Vietnamese countryside. Along with Orange, which received its name from the orange stripe around storage barrels, Agents Blue and White were designed to destroy crops, depriving Viet Cong soldiers of food and forest brush cover that might hide enemy troops.²⁰

From the beginning spraying operations received heavy criticism. Antiwar activists charged that the herbicide campaign qualified as chemical warfare and violated the 1925 Geneva Convention prohibition on such military weapons. Others raised questions about the ethics of destroying crops in a part of the world that routinely saw people die of starvation. As the war continued, and the amount of herbicides used increased, biological and environmental scientists began expressing concerns about the possible long-term effects of herbicide defoliation on the Vietnamese countryside and possible harmful health effects on the Vietnamese people.²¹ In 1969, the release of a report conducted by the

Effects of 2,4,5-T on Man and the Environment, April 7 and 15, 1970 (Washington, D.C., 1970).

¹⁹ Karen DeWitt, "House Hearing Is Told Dow Knew in 1964 That Defoliant Was Toxic," *New York Times*, 23 July 1980, A18.

²⁰ Alvin L. Young, "The Toxicology, Environmental Fate, and Human Risk of Herbicide Orange and Its Associated Dioxin," Technical Report (Brooks Air Force Base: USAF Occupational and Health Laboratory, Oct. 1978), I-10, Young Collection.

²¹ Charles Mohr, "U.S. Spray Planes Destroy Rice in Vietcong Territory," *New York Times*, 21 Dec. 1965, p. 1; Benjamin Welles, "Pentagon Backs the Use of Chemicals," *New York Times*, 20 Sept. 1966, p. 1; Russell Betts and Frank Detton, *An Evaluation of Chemical Crop Destruction in Vietnam* (Memorandum: Office of the Assistant Secretary of Defense, Oct. 1967), 8, 9; Edward B. Fiske, "Clerics Accuse U.S. of War Crimes," *New York Times*, 4 Feb. 1968, p. 1; Bryce

Bionetics Research Laboratories for the National Cancer Institute attracted even more critics. The report suggested that the phenoxy herbicides potentially could cause human harm, including birth defects. A follow-up investigation commissioned by the Department of Health, Education, and Welfare was undertaken, with the results released late in 1969. The Mrak Report supported the conclusions of the Bionetics study, and recommended that 2,4-D and 2,4,5-T both be immediately restricted to prevent human exposure. These health studies only intensified the public debate over the defoliation campaign and fueled further investigation on the part of government and scientific societies. The Department of Defense sponsored a study of the ecological effects of heavy herbicide usage in 1967, while the American Association for the Advancement of Science sent a team of scientists to Vietnam in 1970 to evaluate the environmental harm to the Vietnamese people and mangrove forests. Concerns over the safety of DDT, the pesticide singled out in *Silent Spring*, had already forced Richard Nixon's administration to begin revising federal chemical regulation and environmental policy.²²

Nixon appointed a commission to study the effects of pesticides, the very Mrak Commission that supported the findings of the Bionetics study. As a result of the Mrak Commission's findings, early in 1970 the USDA cancelled all residential use of DDT, with further review of other uses of the chemical (agricultural and industrial) expected to follow. An article by Thomas Whiteside on defoliation operations published in *The New Yorker* prompted the Senate to set up a Subcommittee, headed by Democrat Senator Philip Hart, to investigate pesticide use. Congressional representative Richard D. McCarthy (D-NY) entered his findings from hearings held in Globe, Arizona, where residents charged that U.S. Forest Service spraying of the Tonto National Forest had produced deformities in domestic animals. Opponents of defoliation used the public questioning of pesticide safety to urge stopping spraying operations in Vietnam.²³ Nixon and his advisors thought that the creation of the Environmental Protection Agency in 1970 would help the administration promote itself as pro-

Nelson, "Herbicides in Vietnam: AAAS Board Seeks Field Study," *Science* 163 (3 Jan. 1969): 58, 59; Arthur W. Galston, Letter to the Editor, "Defoliant in Vietnam," *New York Times*, 2 Oct. 1969, p. 46; Thomas Whiteside, "Defoliation," *The New Yorker* (7 Feb. 1970), 32-69.

²² W. B. House, et al., *Assessment of Ecological Effects of Extensive or Repeated Use of Herbicides* (Kansas City, Missouri: Midwest Research Institute/DOD, 1967); J. Brooks Flippen, "Pests, Pollution, and Politics: The Nixon Administration's Pesticide Policy," *Agricultural History* 71 (Fall 1997): 443-45.

²³ "Major Congressional Action: Effects of Herbicides," *1970 CQ Almanac* (Feb. 1970), 495, folder 10, box 3, Paul Cecil Collection (Texas Tech University: The Virtual Vietnam Archive); hereafter cited as the Cecil Collection; for congressional debates on defoliation, see "Environmental Warfare in Vietnam," *Congressional Record—Senate* 116 (19 Feb. 1970), 91st Cong., 2^d Sess., 4111-12.

environmental, while at the same time protecting the interests of agriculture and industry. As a result of the new agency, the oversight of pesticides moved from the Department of Agriculture to the EPA.

The USDA's previous oversight of pesticide regulation and the fact that it oversaw the Forest Service, a major user of herbicides during the 1970s, meant that agency officials and scientists remained significantly influential regarding pesticide policy. This influence also complicated things for officials at the EPA, as they increasingly found themselves charged with investigating and regulating issues of environmental risk. After months of political posturing, industry legal action, and bureaucratic maneuvering, the Nixon White House banned the use of Agent Orange in Vietnam in April 1970, but Agent Orange herbicides continued to be sold domestically despite official EPA cancellation of 2,4,5-T's registration.²⁴ In 1971, after Johnson's testimony at the Hart hearings, Dow and Hercules, Inc., sought to void the cancellation of 2,4,5-T. This allowed the companies to continue selling the herbicide while a special advisory committee was formed to perform the administrative review. The nine-member committee, drawn from members of the National Academy of Sciences, submitted a report to the EPA. Leaks of the unpublished report suggested that it was contradictory at best, disingenuous at worst. The major problem with 2,4,5-T, the committee asserted, lay with its contamination with dioxin. Such minor "environmental leaks" were acceptable in the eyes of the committee.²⁵ EPA administrator William D. Ruckelshaus decided, however, to continue the existing restrictions on 2,4,5-T in contradiction to the advisory committee's recommendation. Ruckelshaus' decision highlighted the "shambles into which the official decision-making machinery [of the EPA] has lapsed."²⁶ Domestic use of 2,4,5-T would continue. A commentary on the embarrassing role played by the National

²⁴ The actual process by which Agent Orange was discontinued and the different policy decisions, agencies, and legal action make for a very confusing story. I have significantly compressed and summarized this process for this essay. For a history of the association between the USDA's Bureau of Entomology and industry, see Thomas R. Dunlap, "Farmers, Scientists, and Insects," *Agricultural History* 54, in "Agricultural History Symposium: Science and Technology in Agriculture" (Jan. 1980): 93-107; Jonathan B. Tucker, "A Farewell to Germs: The U.S. Renunciation of Biological and Toxin Warfare, 1969-1970," *International Security* 27 (Summer 2002): 107-48, discusses the evolution of Nixon's policy and the eventual banning of Agent Orange in Vietnam; Carol Van Strum, *A Bitter Fog: Herbicides and Human Rights* (San Francisco, 1983), 14, 15; for the EPA's charge, see Sheila Jasanoff, "Science, Politics, and the Renegotiation of Expertise at EPA," *Osiris*, 2^d ser., 7, "Science after '40" (1992): 197, 198.

²⁵ Thomas Whiteside, "Department of Amplifications" *The New Yorker* (14 Aug. 1971), folder 09, box 02, Douglas Pike Collection: Unit 03 - Technology, accessed on The Virtual Vietnam Archive, Texas Tech University.

²⁶ Nicholas Wade, "Decision on 2,45-T: Leaked Report Compels Regulatory Responsibility," *Science*, n.s., 173 (13 Aug. 1971): 615.

Academy of Sciences, which provided a list of possible candidates, but had no say in who was chosen for the committee, pointed to the approval expressed by industry groups like the National Agricultural Chemicals Association. “With verdicts like that of the 2,4,5-T committee, the pesticide manufacturers’ satisfaction with the status quo is no more surprising than the Academy’s discomfiture.”²⁷ Dow successfully overturned the cancellation when Ruckelshaus failed to hold public hearings, as required by the Federal Insecticide, Fungicide and Rodenticide Act.²⁸

Most historians credit the 1962 publication of Rachel Carson’s *Silent Spring* as a major influence in the emergence of the modern environmental movement. Carson, however, simply condensed and popularized information based on over a decade of studies and growing scientific concern in the 1950s over the effects of DDT use on the natural environment and human health.²⁹ Given that pesticide use increased dramatically between the publication of the book and 1972, the year DDT was finally banned, it was a much-needed clarion call.³⁰ While Carson had alerted the American public, opponents of chemical pesticides shifted from a campaign of public information and education to one of litigation by the late 1960s, most significantly in the Wisconsin hearings of 1968 and 1969. Using over two decades of scientific studies, the Environmental Defense Fund (EDF) successfully changed not only the legal and regulatory climate but also public opinion about the necessity of using persistent chemical insecticides.³¹ Although the battle would have to be fought again against the EPA, the EDF’s legal efforts finally resulted in the banning of DDT in 1972. As an iconic chemical, DDT appeared to be the first of many victims of the new understandings of the environment influenced by *Silent Spring*, understandings less than sympathetic to industry and industrial products.³² The EDF also stood as the exemplar of Metzger’s “coercive utopians” or Brandt’s “flower children,” and such groups—local, regional, and national—would become the avowed enemies of Dow Chemical.

Determining the toxicity of 2,4,5-T remained an elusive process, although evidence slowly mounted. In a September *BioScience* article, Dow vice-president Johnson presented a lengthy summary of the existing

²⁷ “2,4,5-T Committee: Bias Untested, Academy Embarrassed,” *ibid.*, 611. The committee was chosen by the USDA, a longtime industry ally.

²⁸ Van Strum, *Bitter Fog*, 14, 15.

²⁹ Thomas R. Dunlap, *DDT: Scientists, Citizens, and Public Policy* (Princeton, N.J., 1981), 59-71.

³⁰ David Pimentel, “After *Silent Spring*: Ecological Effects of Pesticides on Public Health and on Birds and Other Organisms,” in *Rachel Carson: Legacy and Challenge*, ed. Lisa Sideris and Kathleen Dean Moore (Albany, N.Y., 2008), 190-94.

³¹ Dunlap, *DDT*, 130, 197-209, 231.

³² Steve Maguire, “Contested Icons: Rachel Carson and DDT,” in *Rachel Carson: Legacy and Challenge*, ed. Sideris and Moore, 194-214.

information on exposure, toxicity, and chemistry of 2,4,5-T. Johnson cited extensively from unpublished data from Dow Chemical and concluded that “the widespread use of phenoxy herbicides has produced no demonstrable evidence of potential harm to man.”³³ According to Johnson, the rapid degradation of the phenoxy herbicides made them safe for use. Disagreement continued, however. Part of the problem, as one researcher noted, lay in “the inadequacy of present practices surrounding the design and analysis of toxicological experiments.”³⁴ The 1973 announcement of the detection of dioxin in frozen fish samples typified the growing body of scientific evidence indicating potential harm. The samples, taken by the American Association for the Advancement of Science’s 1970 Herbicide Assessment Commission, provided the “first hard evidence that TCDD [dioxin] is indeed finding its way into animals—and thus into a food chain that could include man—in Vietnam.”³⁵ Events in Oregon would bring the 2,4,5-T/dioxin controversy to a head.

Carol Van Strum opens her book *A Bitter Fog* recounting a spring day in 1975. Four children had gone fishing in the local river when a tank truck sprayed herbicides along the sides of the road, just above the river bank where the children played. Drenched, the children all became sick that night, with symptoms that included burning skin, mouths, throats, and eyes. Garden plants wilted and died, and the family dog was eventually paralyzed, covered with oozing sores. This episode marked Van Strum’s involvement with a substance that would consume her life, sometimes literally, for the next decade. The Van Strums began alerting the county health department, wildlife rangers, the Forest Service, and the EPA. Their letters to the EPA were answered by the USDA, which reassured the Van Strums that no studies had demonstrated the effects they had described. Steve Van Strum researched the herbicides at the Oregon State University library, and the couple requested a copy of the 1976 Environmental Impact Study (EIS) put out by the Forest Service. In the process of researching the chemical herbicides, the Van Strums contacted reporter Thomas Whiteside, who had published extensively on Agent Orange herbicides. He referred them to more studies and scientists who had expressed concern about the safety of 2,4-D, 2,4,5-T, and the TCDD present in the herbicides used to clear roadways and manage local timber stands. Frustrated and concerned, the couple let the matter drop.³⁶ Officials had already ignored earlier concerns.

³³ Julius E. Johnson, “The Public Health Implications of Widespread Use of the Phenoxy Herbicides and Picloram,” *BioScience* 21 (1 Sept. 1971): 905.

³⁴ Theodor D. Sterling, “Difficulty of Evaluating the Toxicity and Teratogenicity of 2,4,5-T from Existing Animal Experiments,” *Science*, n.s., 174 (24 Dec. 1971): 1358.

³⁵ “Dioxin from Defoliation Found in Vietnam Fish,” *Science News* 103 (5 May 1973): 287.

³⁶ Van Strum, *Bitter Fog*, 1-9.

Dependent on the timber industry for many of its citizens' economic livelihood, Oregon became the battleground over which industry (timber and chemical), citizens, and government agencies fought. As the major industry in the state, timber interests exerted significant political and social influence throughout the 1950s and 1960s. The state's 1941 Forest Conservation Act effectively decreased the amount of federal regulation, and the timber industry acted in its best interests. One problem that plagued loggers was the lack of access roads, which made it difficult to access valuable old-growth timber.³⁷ Roads would be built and access maintained through the application of herbicides. The Forest Service also began spraying timber stands with herbicides to achieve better brush control and to lessen the chances of fire. Jean Anderson and her husband Ugo Pezzi owned a 1,300-acre ranch bordering on Indian Creek, in the Five Rivers area and close to the Suislaw National Forest. The couple requested information from the Forest Service in 1972 after their land was exposed when herbicides were sprayed in 1971. Concerned about the herbicides' effects on their organic beef herds, not to mention their own water supply, Anderson and Pezzi requested a public hearing in 1973. When the couple filed a lawsuit after a Forest Service official denied the public hearing, the Forest Service agreed to not spray the area's watershed.³⁸ Subsequent events late in 1975 ignited local residents' concerns over the potential hazards of the phenoxy herbicides.

In a December 1975 newspaper article, Oregon State faculty member Michael Newton proclaimed the safety of herbicide sprayings and alarmed the Van Strums in the process. Newton, a member of the 1974 National Academy of Sciences team that assessed herbicide spraying in Vietnam, advocated for herbicide spraying to control for undesirable timber growth and increase more valuable timber types. The Van Strums responded to the story, and in the process drew the attention of the local community to the problems many attributed to herbicide exposure.³⁹ This mobilization proved to be the genesis of an organization formed to represent the communities of Five Rivers and Deadwood Creek, Citizens Against Toxic Sprays (CATS). The situation intensified, and along with the Oregon Environmental Council and the Hoedads (a tree planting cooperative), CATS filed suit in 1976 to stop spraying in the Suislaw National Forest. The groups charged that the Forest Service EIS's from 1975 to 1977 had been inadequate. The Industrial Forestry Association joined the Forest Service as a defendant. CATS and its allies filed a new motion that sought to ban 2,4-D, 2,4,5-T, and Silvex.⁴⁰ Tensions rose as local residents confronted Forest Service and county officials determined to carry out

³⁷ William G. Robbins, *Landscapes of Conflict: The Oregon Story, 1940-2000* (Seattle, 2004), 169, 170.

³⁸ Van Strum, *Bitter Fog*, 55, 56.

³⁹ *Ibid.*, 77-83.

⁴⁰ Robbins, *Landscapes of Conflict*, 197.

spraying operations.⁴¹ In March, Judge Otto Skopil issued a temporary injunction banning the use of 2,4,5-T and Silvex pending Forest Service explanation of the effects of dioxin on human and animal health. In 1977, Skopil approved the revised EIS, removing the injunction against herbicide spraying. Three-fifths of a planned 150,000 acres would be sprayed with 2,4,5-T. This would be the state of affairs until the results of a controversial EPA study that linked herbicide exposure to miscarriage rates three times the national level were released in 1978.

Dow used several strategies to discredit the possible link between 2,4,5-T sprayings and miscarriages. In summer 1978, Bonnie Hill and seven other women living in Alsea, Oregon, contacted the EPA concerning thirteen miscarriages that the eight women had experienced since 1973. In response to its investigation, early in March 1979 the EPA issued an emergency suspension of 2,4,5-T and Silvex and began a more intensive study analyzing greater numbers of soil, water, animal meat, and human milk samples to determine the presence of dioxin (this larger and more intensive study would be known as Alsea II). The study attracted the attention of the mainstream news media, including investigative pieces by syndicated columnist Jack Anderson and ABC's news series *20/20*. The Council of Agricultural Science and Technology (CAST) criticized the *20/20* segment. Dow flew Oregon State expert Michael Newton and his wife to Midland, Michigan, to strategize.⁴² CAST, however, had begun to attract negative attention of its own, as the full membership of the organization, beyond its twenty-five independent societies became known. Over two hundred agricultural business corporations and industrial trade organizations also belonged to the organization, and those members provided 57 percent of its operating budget. Such relationships raised questions about the group's claim to scientific neutrality.⁴³ Dow itself challenged the Alsea study as "unscientific" and "seriously flawed."⁴⁴ Dow chairman Earle B. Barnes betrayed a more revealing attitude in a written response to a clergyman when he characterized the Alsea area as one similar to "northern California and other northwestern states in growing marijuana in open spaces and in forests." These illegal marijuana crops, worth \$900 million in California alone, were susceptible to the 2,4,5-T

⁴¹ Van Strum, *Bitter Fog*, 91, 92.

⁴² Robbins, *Landscapes of Conflict*, 200-203.

⁴³ Robin Marentz Henig, "Agriculture's Strange Bedfellows: CAST-Industry Tie Raises Credibility Concerns," *BioScience* 29 (Jan. 1979): 9. The May 1979 issue contained several letters to the editor regarding the CAST article, among them one from John E. Donalds, Agricultural Products Department, Dow Chemical U.S.A. Donalds questioned whether "highly respected and dedicated scientists" could be bought for \$5,000 annual dues. "CAST Profile Evokes Avid Response," *BioScience* 29 (May, 1979): 279.

⁴⁴ Jeffrey Smith, "EPA Halts Most Use of Herbicide 2,4,5-T," *Science*, n.s., 203 (16 March 1979): 1090-92; "Dow Attacks Study Used to Ban 2,4,5-T," *Science News* 115 (17 March 1979): 166.

herbicides used by the Forest Service to kill underbrush. Barnes implied that the reports, which had shown “no valid relationship between the spraying and miscarriages,” were prompted by financial interests rather than health concerns.⁴⁵ In a more creative fashion, Dow offered a scientific discovery as one explanation for the ubiquitous presence of dioxin.

In 1977, Dow scientists focused their energies on discovering the source of dioxin contamination that had polluted the Tittabawassee River, the major waterway in which Dow discharged its manufacturing wastes. Their concern was increased by the knowledge that the EPA or the Michigan Department of Natural Resources could shut down the Midland plant, which was the only Dow facility that manufactured pesticides. In November 1977, Dow company officials announced they had found the culprit: the “entire environment.” Dioxin levels were detected not only in fish from the river, but also in ash from incinerators, power plants, fireplaces and charcoal grills—anyplace where combustion took place. In the words of one official, “We now think dioxins have been with us since the advent of fire.”⁴⁶ Warren B. Crummett, the technical director of Dow’s analytical labs, discussed the hypothesis, “the trace chemistries of fire,” in his 2002 memoir, *Decades of Dioxin: Limelight on a Molecule*. Crummett criticized the EPA’s failure to achieve balanced scientific judgment on acceptable dioxin levels, claiming that “veiled advocacy is still evident in the interpretation of the data.”⁴⁷ John Davidson, a Dow chemist, gave a more forthcoming description of the discovery: “We learned so much about dioxins in order to defend our pesticides.”⁴⁸ If nothing else, the discovery of the universal presence of dioxins, according to the scientist in charge of the investigative team, meant that no one needed to worry about them. At the very least, Dow scientists offered up the theory as one reason for the geographic presence of dioxin contamination.⁴⁹

Scientists continued to debate the safety of 2,4,5-T and its associated dioxin contamination, even as the EPA fought to maintain its emergency suspension of the chemical. Some confidently proclaimed that the herbicide posed no hazard to human or animal kind, even if the individual invoked less than reliable support, such as Auburn professor Donald E. Davis did in a 1979 *BioScience* article looking at the history of 2,4,5-T. Davis gave a general account of the chemical’s history, but also relied on a 1974 CAST report and the contradictory National Academy of Science’s

⁴⁵ Brandt, *Growth Company*, 367. Brandt notes that this was the “first and only time Dow used [this] argument.”

⁴⁶ R. Jeffrey Smith, “Dioxins Have Been Present Since the Advent of Fire, Says Dow,” *Science*, n.s., 202 (15 Dec. 1978): 1166.

⁴⁷ Warren B. Crummett, *Decades of Dioxin: Limelight on a Molecule* (Philadelphia, Pa., 2002), 223.

⁴⁸ Smith, “Dioxins Have Been Present,” 1167.

⁴⁹ Etcyl H. Blair, “The Safety of 2,4,5-T,” *Science*, n.s. 206 (7 Dec. 1979): 1136.

report on herbicides in Vietnam.⁵⁰ Professor Arthur Galston, who had worked on the plant growth inhibitors as a graduate student at the University of Illinois, offered a much more cautious, although no more definitive, assessment of 2,4,5-T. He recognized that industry and environmental scientists disagreed on the evidence and what policy decisions should be made. His own professional judgment urged “extreme caution,” and he acknowledged that other classes of herbicides might prove equally dangerous. No matter the financial or emotional cost, however, Galston cautioned that the public welfare might demand the banning of industry’s favorite compounds.⁵¹ An April 12, 1979, court ruling denied the request by a coalition of timber industry, chemical manufacturers, and herbicide applicators (including Dow) that the emergency suspension be lifted. The EPA’s case, dependent on the Alsea study, appeared to be weak. It was not helped by the conviction of one of its lead scientific witnesses for stealing funds from his government grant.⁵² For Dow management, it was imperative to fight to keep 2,4,5-T legal. As Dow executive Paul Orefice described it: “If we let them ban a product that has 30 years of studies behind that says it’s safe, what happens to the next product, and the next product, and the next?”⁵³ The court case dragged until Dow eventually conceded the battle in 1983, \$10 million later.

Dow continued to fight Americans’ changed environmental consciousness, as it defended its pesticide products. A 1981 issue of *The Bottom Line*, Dow’s free newsletter, proclaimed the publication as the “final conclusion about the role of pesticides in society . . . THE BOTTOM LINE is also an information clearinghouse for scientific facts about the pesticide dilemma.”⁵⁴ The lead story, entitled “A Familiar Scenario with a New Cast,” examined the script written by the Alsea, Oregon, case and the “pesticide road show being restaged in Missoula, Montana; Ashford, Washington and Peevy’s Crossing, Oklahoma.”⁵⁵ The article went on to applaud the formation of a group in Montana, Citizens for Food and Fiber, dedicated to “prompt collective action. . . .” Another citizens’ group had formed in Washington, the Washington State Pest Management Alliance, committed to “scientific reason and rationale” in putting out the anti-

⁵⁰ Donald E. Davis, “Herbicides in War and Peace,” *BioScience* 29 (Feb. 1979): 94.

⁵¹ Arthur W. Galston, “Herbicides: A Mixed Blessing,” *ibid.*, 84.

⁵² R. Jeffrey Smith, “Court Reluctantly Upholds EPA on 2,4,5-T Suspension,” *Science*, n.s., 204 (11 May 1979): 602; Susan Walton, “2,4,5-T: Case Study in Regulatory Confusion,” *BioScience* 30, “Food from Microbes” (June 1980): 427; William J. Broad, “Ski Trips Cost Researcher His Job,” *Science*, n.s., 207 (15 Feb. 1980): 743, 744.

⁵³ Brandt, *Growth Company*, 364.

⁵⁴ Dow Chemical Company, *The Bottom Line*, Jan. 1981, folder 5961, box 212, Young Collection.

⁵⁵ *Ibid.*

pesticide fires. As the article editorialized, “It is time for more of this kind of citizen action, where grass roots elements representing farmers, foresters, applicators, agri-women and other proponents of free enterprise defend the agricultural chemical tools that are important to everyone’s standard of living.” Finally, *The Bottom Line* included a poem by an anonymous author, “Silent Fall.” A clear satire of *Silent Spring*, the poem told of the downfall of civilization as society banned a wide array of agricultural chemicals, condemning the surviving humans to grow their own food. “The remaining few lived like animals. Feeding themselves on creatures and plants around them. And these were called Organic Foods.”⁵⁶

Dow Chemical spent more than a decade fighting the agenda of the “coercive utopians” and defending the free enterprise system. In the process, it played a major role in contesting the scientific knowledge of herbicide safety, the right of the state to set regulatory policy, and the concerns of ordinary citizens over the safety of everyday chemicals that were sprayed on their fields and trees. It appears unclear whether Dow Chemical won its case against the covert, subversive “flower children” determined to change business as usual in Washington and throughout the country. Ironically, by the end the company seemed to have conceded the success and power of the counter-culture, seeking to create its own grassroots social movement of farmers, sprayers, and agri-women. Given its involvement with some of the most contentious events in the postwar period—the use of napalm and Agent Orange during the Vietnam War, toxic chemicals and the emergence of a risk-averse society—Dow tried to remain true to its vision of an America composed of free opinions, citizens, and enterprise.

⁵⁶ Ibid., 3.

Economic coercion will be part of this. Coercion also serves domestic political purposes for Beijing, which has cultivated rising nationalism domestically and which can use coercive economic measures to show domestic political audiences that China is acting to punish countries and companies that fail to conform to Beijing's wishes. It is possible that in the midterm Beijing will formalize some of its coercive economic measures, particularly if Beijing adopts a planned Export Control Law, though China is likely to continue relying on informal and extralegal measures for the majority of its economy. Dow Chemical chairman and CEO Andrew Liveris is a close adviser to President Donald Trump. The company wrote a \$1 million check to help underwrite Trump's inaugural festivities. Pesticide study. "We have had no meetings with Dow on this topic, and we are reviewing petitions as they come in, giving careful consideration to sound science and good policymaking," said J.P. Freire, EPA's associate administrator for public affairs. "The administrator is committed to listening to stakeholders affected by EPA's regulations, while also reviewing past decisions." The office of Commerce Secretary Wilbur Ross, who oversees the Natural Marine Fisheries Service, did not respond to emailed questions. Science in film, and usual equivalents such as science on film or science on screen, refer to the cinematographic representation, staging, and enactment of actors, information, and processes involved in any aspect or dimension of science and its history. Of course, boundaries are blurry, and films shot as research tools or documentation also display science on screen.