Chapter 31

The Pacific Northwest cases

The hazards posed by fluoride emissions from aluminum smelters were known to the general public before the Anaconda Aluminum Co. started to build a third potline at its smelter in Columbia Falls in the mid-1960s. According to a 1978 National Geographic story on "Aluminum, the Magic Metal," problems caused by fluoride emissions from aluminum smelters were well known during the 1950s. Farmers noticed that some vegetation became blighted, and cattle which fed on affected plants became lame and their teeth wore down rapidly. The media had reported on the problem, and the resulting court cases became known as "cattle suits," the magazine reported. [1] This was especially true in the Pacific Northwest. According to the Washington State Department of Ecology, "The smelters built in the early 1940s were constructed without control scrubbers and chemical wastewater treatment systems. These early control systems were installed because of the environmental damage caused by fluoride emissions. Smelters built between 1950 and 1970 were built with pollution control facilities." [2]

The harmful impacts of fluoride emissions from an aluminum smelter on surrounding land is related to the amount of metal produced by the plant and the effectiveness of primary and secondary emissions controls. Between 1950 and 1970, the capacity of individual Pacific Northwest smelters significantly increased, effective dry scrubber technology was not in general use for treatment of primary emissions, and secondary emissions control was mostly absent. In 1970, as state governments in the Pacific Northwest began to write new fluoride emission standards using advice and data from aluminum companies in Oregon and Washington, the Bonneville Power Administration began to take a second look at a provision included in its standard power contracts that allowed the BPA to refuse to deliver power to industries that polluted water. At the time, ample evidence existence showing that some regional aluminum producers did, in fact, pollute the region's rivers and streams, but how that provision applied to air pollution was a matter of interpretation. The Public Power Council, a foundation program of the Northwest Public Power Association, participated in a rewrite of the BPA policy that favored industry, according to William H. Rodger's 1973 book "Corporate Country: A State Shaped To Suit Technology." Founded in 1940, the Northwest Public Power Association represented public and private utilities in the U.S. and Canada.

Industry influence on regulations

A major player in the drafting of new air quality standards in the Pacific Northwest was the Aluminum Association. The industry trade group originated in 1933 after Congress passed the National Industrial Recovery Act, which requested that each industry establish codes and guidelines for fair competition. Representatives from Alcoa, Reynolds and nine aluminum companies met in Pittsburgh to set up these codes and formed the Association of Manufacturers in the Aluminum Industry. The members voted to maintain the organization after the National Industrial Recovery Act was repealed in 1934 under a new name – the Aluminum Association. Through the 1930s, the group focused on expanding aluminum uses, including issuing a technical report on corrosion resistance of aluminum cylinder heads. Following World War II, by then representing the Big 3 and other aluminum companies accounting for 85% of U.S. aluminum fabrication, the Aluminum Association continued to focus on expanding aluminum uses, standardizing metal specifications and other production market programs. That included promotional efforts during the 1950s. [3] But the Aluminum Association's work to protect aluminum producers from environmental regulations that could affect production and profits, including participating in lawsuits, is less well known.

In 1970, Jerry Hildebrandt, from Washington State's Air Quality Bureau, and Fred Skirvin, from Oregon's Air Quality Bureau, turned to the Aluminum Association when trying to establish new fluoride emission standards for their states. The Aluminum Association cooperated by sending experts to a meeting in Olympia, Wash., on Jan. 7, 1970, which was also attended by representatives from the region's aluminum industry. Of the 13 experts providing advice and information, only Walter Heck, from the federal National Air Pollution Control Administration, the predecessor to the Environmental Protection Agency, was not directly tied to the aluminum industry. Those in attendance were aware of an ongoing lawsuit brought by farmers against the Harvey Aluminum Co.'s smelter in The Dalles, Ore. Heck later criticized the meeting in a letter he sent to the NAPCA office in San Francisco. "I was somewhat surprised at the recommended standards because they represent the values applying to The Dalles situation," Heck said. "There is adequate information in the literature to suggest that these levels are barely marginal and give no latitude for error. I believe the states of Washington and Oregon would be doing a disservice to the aluminum industry, the farmers and the general public by adopting these standards." [4]

On Jan. 20, 1970, Don Winson, a Pittsburgh attorney representing the Aluminum Association, asked three industry experts to testify at another hearing on fluoride emissions to be held in Olympia on Feb. 25, 1970 – W.J. Suttie, an author of an Aluminum Association scientific brochure; Leonard Weinstein, an industry consultant;

and Delbert McCune, the author of another Aluminum Association brochure. Weinstein and McCune also worked for the Boyce Institute on Plant Research, which often provided research assistance for aluminum companies facing air pollution lawsuits. Copies of Winson's letter were sent to Joe Byrne, the environmental manager at Harvey Aluminum, as well as L.V. Crallcy at Alcoa and J.C. Dale at the Aluminum Association. Byrne, Crallcy and Dale also sat on the EPA's Primary Aluminum Industry Liaison Committee. The Washington and Oregon air quality bureaus had initially sought the advice of 13 experts, including Suttie, Weinstein, McCune, Byrne and Donald Adams, a Washington State University professor who had testified in fluoride emission cases on behalf of the Intalco smelter in Ferndale, Wash. One expert represented the interests of those harmed by fluoride emissions – A.C. Hill, a biologist at the University of Utah who had served as an arbitrator in litigation against Harvey Aluminum. Only one expert could be said to be totally unbiased – Walter Heck, representing NAPCA's Division of Economic Effects Research. "It is not spectacular corruption that helped the aluminum industry write the state standards for fluorides," William H. Rodgers commented in 1973 on the process to create pollution standards. "Conscientious administrators, trying to do their best, were simply denied options. The premises of the law succumbed to the planning prowess of the Aluminum Association – the data, the experts, the weight of opinion, the common assumptions came from a single source. Its purpose is to minimize liability for damage caused and prevent disruption of existing technology." [5]

The aluminum industry in the Pacific Northwest spent about $131 million on pollution abatement measures between 1973 and 1976. [6] By 1985, state standards for fluoride emissions by aluminum smelters differed between Montana, Washington and Oregon. The Montana standard for total fluoride was 2 pounds per ton of aluminum produced per month, compared to 3.5 for Oregon and no comparable standard for Washington. Both Oregon and Washington provided standards for total particulates for Soderberg pots or prebake pots, which Montana did not because it had only one smelter, the Columbia Falls Aluminum Co. smelter, which used Soderberg pots. Washington provided ambient standards for gaseous hydrogen fluoride, but Montana and Oregon did not. Montana's standard for fluoride in forage was 50 micrograms per gram. Washington provided a similar standard and Oregon did not. [7]

The BPA's 1985 final environmental impact statement for direct-service industry power sales options provided figures for annual atmospheric emissions by the 10 aluminum smelters in the Pacific Northwest: Alcoa in Vancouver, Wash. – 678 tons of particulates, 185 tons of fluoride compounds, 30 tons of hydrocarbon compounds, 1,276 tons of sulfur oxides and 7,023 tons of carbon dioxide; Alcoa in Wenatchee, Wash. – 1,368 tons particulates, 495 tons fluorides, 401 tons hydrocarbons and 2,737 tons sulfur oxides; Reynolds in Longview, Wash. – 1,575 tons particulates and 263 tons fluoride; Reynolds

in Troutdale, Ore. – 877 tons particulates, 162 tons fluoride, 2,799 tons sulfur oxides and 12,822 tons carbon dioxide; Kaiser in Tacoma, Wash. – 600 tons particulates, 158 tons fluoride, 36 tons hydrocarbon, 1,941 tons sulfur oxides and 11,336 tons carbon dioxide; Kaiser in Spokane, Wash. – 1,544 tons particulates, 685 tons fluoride, 404 tons sulfur oxides and 24,132 tons carbon dioxide; Martin Marietta (formerly Harvey Aluminum) in The Dalles, Ore. – 435 tons particulates, 102 tons fluoride, 503 tons sulfur oxides and 15,926 tons carbon dioxides; Comalco in Goldendale, Wash. – 595 tons particulates, 161 tons fluoride and 633 tons sulfur oxides; Intalco in Ferndale, Wash. – 620 tons particulates, 117 tons fluoride, 9 tons hydrocarbons, 5,082 tons sulfur oxides and 37,205 tons carbon dioxides; and Columbia Falls Aluminum Co. in Columbia Falls, Mont. – 837 tons particulates, 456 tons fluoride, 624 tons hydrocarbons and 1,850 tons sulfur oxides. [8]

A history of emissions

Construction of the first aluminum smelter in the Pacific Northwest was announced by Alcoa in 1939. The plant was built on a tidewater sand flat on the Columbia River near Vancouver, Wash. The BPA signed a 20-year 32.5 megawatt power contract with Alcoa in December 1939, and the first transmission line from the Bonneville Dam to the Vancouver smelter was completed at about that time. [9] In 1940, the plant produced 5,000 tons of aluminum. By 1950, the plant had five 50,000-amp potlines with a capacity of 85,000 tons of aluminum per year and employed 1,100 workers. [10] Alcoa began to receive complaints about fluoride pollution from its smelters in Vancouver and East Tennessee causing problems to vegetation and livestock during the 1940s. Major modifications were made at the plants to reduce fluoride emissions, including pot hooding, duct work and fans to collect pot gases, and mechanical separators and wet scrubbers to remove particulates and hydrogen fluoride from the exhaust gases. [11] In 1962, Alcoa paid William Fraser $60,000 for damages to his cattle by fluoride emissions from the smelter in Vancouver. Alcoa also paid Earl Reeder $20,000 for damages to his cattle on Sauvies Island, on the Oregon side of the Columbia River about 10 miles north of Portland. [12]

The second oldest aluminum smelter in the Pacific Northwest was built by Reynolds Metals Co. on the eve of World War II. In 1939, Richard S. Reynolds began to put together financing to build two aluminum smelters in the U.S. By mortgaging the company's 18 plants, Reynolds secured a federal loan to build a smelter in Longview and a smelter and sheet mill in Listerhill, Ala. [13] The 30,000 ton-per-year Longview plant on the Columbia River was estimated to cost $6.5 million to build, financed with a federal Reconstruction Finance Corporation loan. [14] In August 1941, the BPA began providing power to the Longview smelter. [15] By the end of World War II, the plant had been

expanded to 63,000 tons per year. [16] By 1998, the plant was rated at 204,000 tons per year. [17] Reynolds also acquired the smelter plant across the river at Troutdale, Ore. as war surplus after World War II ended. Reynolds began leasing the 72,000 ton-per-year smelter from the War Assets Department in 1946 and completed the purchase of the smelter by 1949. [18]

Air pollution problems became evident soon after the World War II expansion at Longview. Reynolds installed a $500,000 wet scrubber fume control system at its Longview smelter in 1946, which discharged pot gas treatment water into local drainage ditches. By 1948, dozens of farmers and dairymen had filed lawsuits in federal court alleging that gases and fumes from Reynolds' Longview and Troutdale smelters had damaged crops, stunted cattle growth and harmed milk production. Reynolds had previously settled out of court with farmers complaining of property damage. In 1953, a U.S. District Court judge awarded a dairy farmer in Rainier, Wash., $14,000 for property damage allegedly caused by Reynolds' smelter fumes, but a federal judge in 1954 ruled in favor of Reynolds in an $875,000 damage lawsuit filed by several groups of farmers. The judge in the latter case said the court was satisfied that the aluminum plant's usefulness and importance to the economy and national security "far outweigh any injury to plaintiffs shown by the evidence." [19]

In 1970, as the Washington State Air Pollution Control Board considered standards to control aluminum plant emissions, Reynolds experimented with different technologies to reduce air pollution. A bluish haze blanketed Longview's industrial sector. A Rainier man, angry that he could barely see the Washington side of the Columbia River, dumped a truckload of scrap metal in front of Reynolds' office building on Industrial Way in Longview. In 1971, state officials informed aluminum companies that they had until January 1975 to comply with new air pollution standards. Reynolds began planning for a $25 million clean-air program. In 1973, as part of the city Longview's 50th anniversary celebration, Reynolds presented environmental exhibits that included a scale model of the plant's new electrostatic precipitators that were expected to remove fluoride particulates from the smelter's emissions. [20] By fall 1975, Reynolds had finished installing 31 electrostatic precipitators to handle pot gas from the smelter's six potrooms at a cost of $25 million. A local TV station was present during the dedication ceremony. The wet-plate precipitators put the plant "in full compliance with all Washington state regulations for aluminum plant emissions," the company's newsletter stated. The opacity and particulate regulations were set by the Washington Department of Ecology. [21]

The federal Defense Plant Corporation built the Mead aluminum smelter near Spokane in 1941 just before the start of World War II. The Kaiser Aluminum and Chemical Co.

took over operation of the plant in 1946 and signed a 17-year power contract with the BPA. [22] Kaiser purchased the smelter from the government on July 29, 1949. [23] By 1950, the Mead smelter had six potlines and was capable of producing 108,000 tons per year, about 15% of the total U.S. capacity. The smelter employed about 1,100 workers. [24] In December 1950, Kaiser announced that it would spend $3 million to install air pollution control systems at the Mead smelter. The announcement came after George Fischer of Washington State University released the results of a study conducted on pine trees damaged by fluoride emissions. A Kaiser spokesperson acknowledged that "the company had been concerned about smoke and fume control for several years." Kaiser had conducted its own study of the air pollution problem through the Stanford Research Institute and other consultants. The Mead smelter was in the center of an "area of principle damage," along with the Pacific Northwest Alloys plant and the Phillips Petroleum plant. The scientists found concentrations of fluoride in pine needles as far as 12 miles away, and they ruled out other causes for the damaged trees, such as insects, cold winters or heavy precipitation. These other causes may have only contributed to the damage caused by the fluoride, the scientists said. The study concluded that it was impossible to accurately study the effects of the fluoride beyond the damaged area. The scientists never pinpointed the sources of the fluoride, but they commended the three companies for their interest in trying to discover a cause. [25]

Residents in western Montana at the time often relied on newspapers and later television stations in Spokane for the news. Reports of pollution by the Mead smelter were available to Montana residents in the early 1950s. On Jan. 11 and 12, 1951, during a Montana Conservation Council meeting at Montana State College in Bozeman, Charles W. Waters of Montana State University in Missoula reported on the impacts of fluoride pollution around the Spokane area. This news was reported in the Hungry Horse News in Columbia Falls as the Harvey Machine Co. began soil testing for construction of a new aluminum smelter at Rose Crossing, just north of Kalispell. [26] Meanwhile, studies continued on the impacts of fluoride emissions in the Spokane area. In 1951, C.G. Shaw, G.W. Fischer, D.F. Adams and M.F. Adams reported in the Journal of Phytopathology on extensive field studies they had conducted near Kaiser's Mead plant. They determined that fluoride damage to lodgepole pine was evident within a 99 square mile area – and they determined that the fluorides were emitted by the Kaiser plant. Studies continued for the next six years. In 1957, D.F. Adams, H.F. Applegate and J.W. Hendrix reported in the Journal of Agricultural Food Chemicals on their field study near the Mead smelter. The scientists found that foliar damage to lodgepole pine and gladiolus flowers was highly correlated with atmospheric fluoride concentrations. They reported finding damage to plant life when there was as little as 0.5 parts per billion of hydrogen fluoride in the atmosphere. [27]

A lot of changes in air pollution technology and regulations took place over the next four decades. Effective control equipment was developed and installed by many companies, and studies led to standards enforced by state or federal agencies. In August 1999, Kaiser's Mead smelter was fined $58,000 by the Washington State Department of Ecology for bypassing air pollution control equipment in its carbon-bake furnace. [28] In September 2000, the department fined the Mead smelter $388,000 for air pollution violations between August 1995 and October 1999, the largest fine ever issued in eastern Washington. The department claimed Kaiser unnecessarily released 800 pounds of pollutants per day for nearly four years. Kaiser said it planned to contest the fine. [29] The department alleged the violations at the Mead smelter stemmed from new equipment installed in 1995, but the state did not learn about the violations until September 1998. A Kaiser spokesperson said that at no time was there a danger to the environment or public health. Kaiser had maintained an emissions monitoring program at Mead since 1992, and Kaiser officials claimed their data would show the smelter was in compliance during the time in question. Company officials claimed new federal emission standards allowed three pounds of fluoride emitted per ton of aluminum produced, and Mead emitted only two pounds. A Kaiser official also claimed the state knew about new potroom equipment and had even fined the smelter $4,200 in 1996 for noncompliance, during the time period stated in the state's complaint. The state had learned about the problems from a document sent to the EPA requesting an extension for compliance to federal standards until October 2001, Kaiser officials said. [30]

Kaiser's Tacoma smelter originated as a World War II aluminum plant. In 1942, Olin Industries Inc. built and began operating the smelter for the U.S. Defense Plant Corporation. Kaiser purchased the plant from the War Assets Administration in 1947. The plant was supplied power by the BPA and was capable of producing 24,000 tons per year in 1948. [31] By 1998, the plant was rated at 73,000 tons per year. [32] A bitter 20-month United Steelworker strike from 1998 to 2000 that included a lockout marked the beginning of the end for the plant. Shortly after the labor dispute was settled, skyrocketing energy costs during the West Coast Energy Crisis led Kaiser to shut down the Tacoma smelter in June 2000. Kaiser filed for bankruptcy in February 2002 and sold the facility to the Port of Tacoma in 2003 for $12.1 million. [33]

The Kaiser smelter was not the only heavy industry operating in Tacoma. In 1981, the EPA included Tacoma's Commencement Bay in its list of the 10 worst toxic waste sites in the country. Scientists had discovered liver cancer and other diseases in bottom fish in the bay, and public health authorities had cautioned against eating the fish. A study group of federal, state and local agencies reported that about 250,000 tons of chlorinated chemical wastes had been dumped in the bay from 1950 to 1972, that dangerous chemicals had seeped into the bay from land impregnated by industrial spills,

and that a city well near the bay was closed because of chemical pollution. [34] For nearly 100 years, the American Smelting and Refining Co. (ASARCO) operated a copper smelter in Tacoma. Air pollution from the copper smelter settled on more than 1,000 square miles of surface soil in the Puget Sound basin. According to the Washington State Department of Ecology, arsenic, lead and other heavy metals remained in the soil as a result of the pollution. In 2009, the State of Washington received a settlement from ASARCO, including $94.6 million to pay for cleanup of the copper smelter plume. [35]

As early as the mid-1940s, newspapers in Tacoma reported that fluoride emissions from the war-time aluminum smelter had poisoned cattle and horses pastured on the tideflats. One resident complained that air pollution from the smelter and the Union Bag & Paper pulp mill would discourage investors from coming to Tacoma. Later, military officials warned that the haze hanging over Tacoma hindered flights in and out of McChord Air Force Base, about 11 miles south of the city. [36] Located on 96 acres near the head of Hylebos Waterway, Kaiser's three-potline aluminum smelter produced cast sows and drawn wire. Prior to 1974, the smelter utilized a wet scrubber system to control particulates from pot gas, but they were replaced with a dry scrubber system after 1974. An unannounced inspection in April 1993 by the Washington State Department of Ecology for the facility's wastewater discharge permit reported finding benzo(a)pyrene, indeno(1,2,3-cd)pyrene and chrysene in the discharge waters at concentrations below the marine acute and chronic EPA water quality criteria. [37]

According to a 1972 study by the University of Washington's Department of Civil Engineering, the horizontal-stud Soderberg pots at the Tacoma aluminum plant emitted high particulate concentrations when the crusts were broken to feed alumina to the bath. The crust-breaking period lasted only two to four minutes, but "during these periods large amounts of visible airborne particulates appear to escape into the cell building." Those secondary emissions were not measured in the study. [38] On Aug. 16, 1999, the Washington Department of Ecology fined the Tacoma smelter $48,048 for violating air quality standards for the second time in three months. The smelter allegedly emitted 17.9 pounds of particulate matter for each ton of aluminum produced in February 1999 when the maximum level allowed was 15 pounds per ton. The department had fined Kaiser $37,200 for a similar violation in December 1998. The particulate matter contained polycyclic aromatic hydrocarbons, a human carcinogen that was long-lasting and could build up in food chains to harmful levels. The Department of Ecology blamed inadequate operation and maintenance of the company's smelter process and air pollution control equipment. [39]

The Troutdale cases

The aluminum smelter in Troutdale, Ore., was built by Alcoa in 1941 and operated by Alcoa from 1941 through 1945 for the U.S. Department of Defense. The plant used prebake cells. The Reynolds Metals Co. began leasing the smelter from the War Assets Department on July 18, 1946, and completed purchasing the 72,000 ton-per-year smelter on Dec. 21, 1949. [40] When a "gigantic flood" threatened to inundate the entire plant in 1948, workers sandbagged the dikes along the Columbia River and saved the plant. The plant's capacity was increased in 1951, 1956, 1957, 1961, 1962, 1967, 1971, and 1972, and a new casting house was built. By 1974, and the plant produced 130,000 tons per year with 950 workers. [41] Over the years, the Troutdale plant was sued by local farmers and ranchers for damages caused by fluoride emissions. In 1950, Julius Lampert won his lawsuit against Reynolds in which he alleged fluoride emissions from the Troutdale smelter had burned his gladiolus crops. [42] The Lamperts owned a 100-acre farm near Troutdale where they raised gladiolus bulbs and flowers, and they claimed damages to their plants in 1957, 1958 and 1959. They filed their lawsuit on June 30, 1959. [43]

The Lampert case continued to be litigated in court more than a decade. In 1963, a federal District of Oregon trial judge withdrew the issue of punitive damages liability from the jury. The case was appealed to the Ninth Circuit Court of Appeals, which reversed the district court ruling and remanded on Jan. 16, 1967. During the original trial, the judge instructed the jury that "with regard to punitive damages, it should weigh the apparent value to society of plaintiffs' farming activities." The appeals court rejected this view, stating, "Without doubt, the operation of the Reynolds Metals Company at Troutdale has social value in that community. But in legal contemplation, the company has no obligation to provide that social value, and certainly no right to do so in disregard of its legal obligation not to cause trespass injuries upon the property of plaintiffs. We find no Oregon decision nor, indeed, any decision from any jurisdiction, which supports the weighing process sanctioned by the trial court." U.S. District Court Judge William G. East noted in his 1967 opinion on remand that the appellate court had noted that "the jury could have found that defendant's trespass was done knowingly and willfully, and that it was intentional and in wanton disregard of defendant's obligations." Judge East awarded the Lamperts $10,017. [44] During arguments on appeal to the Ninth Circuit Court of Appeals, a plant manager remarked on Reynolds' approach to air pollution: "It is cheaper to pay claims than it is to control fluorides." [45] Reynolds was joined in amicus briefs by Harvey Aluminum, Alcoa, Georgia Pacific, Weyerhauser and the Association of Oregon Industries. [46]

In an early air pollution case filed in Oregon, U.S. Chief Judge James A. Fee for the District of Oregon awarded damages in the case of Kerr et.al. v. Reynolds Metals Co. on Dec. 18, 1951. The "allowance for damages" totaled $78,225, which included damages to prunes for five parties, to gladioli for 12 parties and to livestock for one party. [47] In his Dec. 11, 1950 opinion in the Kerr case, Judge Fee noted that Reynolds leased the Troutdale plant from the Reconstruction Finance Corporation from Sept. 26, 1946 to Aug. 9, 1949, at which point Reynolds received the deed to the smelter property. The plaintiffs claimed damages by smelter fumes beginning on Jan. 1, 1947, while Reynolds was still leasing the plant from the U.S. government. Judge Fee noted that the lease agreement contained a $300,000 indemnity clause that stated that if claims for damages caused by smelter fumes exceeded that amount, the RFC could determine "whether or not continued operation of the leased premises would be to the best interests of the government." While Judge Fee noted that the indemnity clause did not protect Reynolds from being sued, he was concerned about the role of the federal government in the matter. "It is urged that the United States is an indispensable party to this litigation," he wrote. "If the interests of the United States were considered vital, intervention according to Rule 24 should have been attempted. But apparently the government did not trust its own court." Judge Fee also commented on the defense's argument that aluminum was a strategic metal, noting that "if $300,000 in damages is sufficient to require the closing of the plant, its operation cannot be as vital as we have been led to believe." [48]

In 1951, a local rancher named Paul Martin sued Reynolds for damages to his 1,500-acre dairy farm allegedly caused by fluoride emissions from the Troutdale smelter. At one point the company sued Martin after he erected a billboard sign on his property east of the smelter denouncing Reynolds for killing his dairy cows. When Martin's lawsuit went to court, Reynolds was backed by top attorneys from Harvey Aluminum, Alcoa, Georgia Pacific, Weyerhauser and the Association of Oregon Industries. Years after Martin died in 1964, his widow sold the dairy farm to Reynolds. The Martins' fight with Reynolds lasted 17 years. [49] The Martins' initial lawsuit alleged that fluoride emissions from the Troutdale smelter had caused damage to humans and cattle on their ranch. They asked for $200,000 in damages and settled for $47,135. In 1952, the Martins added to the initial charge by alleging that the pollution had irreparably damaged their health and the health of their daughter. They asked for $350,000 and settled for $38,290. By 1962, the Martins had won judgments totaling $170,000. In 1961, the Martins sued for $2.5 million. Seven years later, on Aug. 6, 1968, Reynolds announced it had settled the lawsuit by purchasing the damaged property. The exact terms of the settlement were not made public. [50]

The Martins had taken over the dairy farm about the same time that Reynolds took over the Troutdale smelter in 1946. The 1,500-acre ranch was bordered by the Columbia River and the Sandez River in Multnomah County. The Sandez River separated the ranch from the smelter by about 6,000 feet. According to court testimony in August 1955, about 700 head of cattle had sickened and died shortly after the Martins began ranching there. Buckwheat leaves within two miles of the smelter contained 125 ppm to 175 ppm fluoride. Windows on the farm house were etched, a condition said to occur when concentrations reached 30 ppb to 40 ppb of fluoride in the air. Normal atmospheric conditions contained 1 ppb to 12 ppb fluoride. According to the plaintiffs, within three to four months after moving to the ranch, Paul Martin, his wife Verla and their daughter Paula all contracted an "unusual" disease later diagnosed by two consultants from Chicago and from England as fluorosis. [51]

According to a 1969 article in the Journal of the International Society for Fluoride Research, Paul Martin exhibited four groups of symptoms involving the skeletal, respiratory, gastrointestinal and urinary systems. He also had pains in his lower spine that radiated into his legs. His spinal movements were restricted, and he was unable to bend down. He developed shortness of breath, coughed and expectorated, especially after exertion. He had heartburn, nausea, diarrhea and bloating of the abdomen. A state of anxiety was "superimposed" upon the physical symptoms. Verla Martin had similar symptoms, but her kidney function was also impaired. Paula developed dental fluorosis, including mottled teeth, dark gums and gingivitis. She also had considerable pain and crepidation in her ankles. She was diagnosed as a victim of fluorosis and toxic hepatitis in conjunction with hypothyroidism and gastric anacidity, the last two being related to fluoride exposure. Paul's and Paula's 24-hour urine specimens had 0.96 ppm and 1.58 ppm fluoride respectively. After hearing extensive evidence, the jury and the appellate court established that chronic fluorosis had occurred to all three. [52]

The Martins won their initial lawsuit against Reynolds in 1955, the same year the Anaconda Aluminum Co. smelter began operating in Columbia Falls. For the first time in the U.S., it had been proved in court that fluoride fumes could cause illness in humans, according to George Waldbott's 1978 book "Fluoridation: The Great Dilemma." The significance of the case was demonstrated by the fact that seven other aluminum, metal processing and chemical companies had joined Reynolds as friends of the court. At the trial's conclusion, the Portland Oregonian reported in 1957, Reynolds' attorney Fred Yerke "contended that, if allowed to stand, the verdict would become a ruling case, making every aluminum and chemical plant liable to damage claims merely by operating." The U.S. Court of Appeals upheld the decision against Reynolds in a 5-1 vote in June 1958. The case wasn't fully resolved until 1968 when Reynolds bought the Martins' ranch. [53]

The establishment of fluoride emission standards eventually led to a number of air pollution control projects at the Troutdale smelter. In fall 1975, work started on installing new equipment in order to comply with Oregon's standards for aluminum plant emissions by 1977. Phase 1 called for installing wet-plate electrostatic precipitators on the carbon plant's discharge stack at an estimated cost of $2.2 million. The precipitators were capable of cleaning 130,000 cubic feet per minute, using two gas conditioners and a clarifying pool to recycle the gas treatment water. [54] By spring 1976, "dark smoke" from Troutdale's carbon plant was gone and work was proceeding on installing a $20 million dry scrubber system for the potlines. The Port of Portland issued $20.7 million in bonds to finance the new system, but costs had increased since then – about three miles of ductwork for four of the plant's five potlines might need to be replaced so pot gases could be routed to the central dry scrubber system. [55] By fall 1976, installation of the air pollution control equipment continued. The dry scrubbers were expected to be operating by 1978 at a cost of $36 million. Developed by S-F Air Control Inc., of Oslo, Norway, the system would use injected alumina to absorb pollutants in a 285-foot long structure south of the potlines. The system included 60 baghouses, 384 cloth bags, two suction fans per potline, and new channel-shaped doors on the hoods of each reduction pot. The new doors would make it easier to change out the anodes every eight hours. [56]

Pollution at The Dalles

A smelter built and operated by Harvey Aluminum, the company that was unable to come up with the financing needed to build a smelter in the Flathead Valley of Montana in 1951, became embroiled in several air pollution lawsuits soon after it first started operating. Harvey announced plans to build an aluminum smelter at The Dalles, Ore., in 1955. The 54,000 ton-per-year smelter was estimated to cost $65 million. Harvey obtained certificates of necessity from the U.S. government allowing the company to amortize 85% of the cost of the plant over a five-year period, along with government guarantees for loans to construct the plant and a contract for power from the BPA. Harvey had a net worth of slightly less than $25 million and net sales of about $34 million. [57] Harvey began operating the smelter on the Columbia River on July 28, 1958, using 300 vertical-stud Soderberg cells. By 1963, the plant employed 550 people and had a gross annual payroll of $3.5 million. [58] The Martin-Marietta Corporation purchased a 40% interest in Harvey in 1968 and took 100% ownership of the company by 1974. [59] The smelter at The Dalles underwent numerous changes over the years as the owners tried to control fluoride and other emissions, but the attempts were not effective for a number of reasons, including insufficient funding or backing by the owners. The company's legal defenses in court turned out also to be insufficient.

In 1961, Harvey paid $300,000 to Fairview Farms for damages to dairy cows, loss of forage and milk supply, and depreciation of the lands caused by fluoride emissions from the company's smelter at The Dalles. Also in 1961, Harvey paid W.J. Meyer and his wife Mary Ann $485,000 for "willful damage" to their cherry, apricot and peach crops by fluoride emissions. [60] In May 1961, a group of plaintiffs alleged that air pollution from the Harvey smelter damaged their cherry, peach, prune and apricot trees. The case, Renken v. Harvey Aluminum Inc., was the first lawsuit filed against Harvey for fluoride emissions from its smelter at The Dalles. The case was appealed to the Ninth Circuit Court of Appeals and was closed in 1966 when the U.S. District Court approved a consent decree providing for arbitration of the growers' claims and dismissal of the related actions filed in state court during the interim. Orchard View Farms Inc. filed a trespass action against Martin Marietta on March 31, 1971, claiming injuries to its orchards between March 31, 1965, and the filing date. A jury trial was held in April and May 1973, and Orchard View was awarded $103,655 in compensatory damages and $250,000 in punitive damages. Martin Marietta appealed the judgment on numerous grounds. The Ninth Circuit Court of Appeals affirmed the compensatory damages but reversed and remanded the punitive damages. [61]

Pollution concerns at The Dalles began before construction had even begun on the smelter. In October 1955, during the pre-construction planning phase for the smelter, the Stanford Research Institute presented a proposal to investigate potential air pollution conditions in the vicinity of future plant. "With some vegetation (such as gladioli and pine trees), a relatively low level of accumulation of fluorides causes injury to the plant material, and even death," the institute said. The proposal called for inspecting the surrounding agricultural areas both before and after commencement of plant operations and for conducting fumigation experiments upon typical vegetation, but the proposal was not accepted by Harvey. The proposal also noted that, "A number of methods may be employed to eliminate, or minimize the effects of, pollutants contained in pot gases collected by hoods. Among those are scrubbing with water, bag filtration, electrostatic precipitation, combustion (for the destruction of tar fog) and discharge from a tall stack." The proposal further noted, "If particulate fluorides and tar fog are present in (pot room) air to an excessive degree, the most feasible method of reducing their influence in the vicinity may be the installation of a tall or high-velocity stack for the discharge of ventilating air." In 1971, Rene LeGault, the smelter's chief design engineer, was asked during the Orchard View Farms air pollution case whether the company had considered the location of the smelter near fruit orchards as a potential problem. LeGault replied that he had "no knowledge of what would be emitted from that plant." No one ever told him and he never asked, he testified. [62]

From the beginning of operation at The Dalles, the vertical-stud Soderberg design cells were equipped with skirts to collect fumes and divert pot gases to a primary emission control system that consisted of a burner at each cell to combust carbon monoxide and tars, a multi-cyclone centrifugal dust collector, a humidifier, a wet-spray scrubber tower and three 40 horsepower fans to draw fumes from the reduction cells to the treatment equipment. In 1960, the plant substituted 60 horsepower motors and added a bubbler to the base of the scrubber tower. A second burner was added to each cell in 1962. The plant tried other equipment to improve performance of its primary control system between 1963 and 1970, including a venturi scrubber, baghouses, a ping-pong ball scrubber, a Ceilcote cross-flow scrubber and a Peterson separator, but none proved practical or suitable. In March 1972, the plant completed installation of wet electrostatic precipitators in its primary control system, but the company did not put hoods over the reduction cells or install taller emission stacks. In 1963, the company installed a secondary emissions control system to capture fumes that escaped the reduction cells into the pot rooms, consisting of wet scrubbers mounted in the roof of the pot rooms. By 1965, the Harvey smelter was the only vertical-stud Soderberg plant with a secondary emissions control system without force-draft fans to direct pot room fumes to the rooftop scrubbers. Fans were installed in 1970-1971, but they didn't necessarily work well. [63]

In 1978, Harold Zeh, a former chemist at Reynolds' Troutdale smelter, visited the Harvey smelter. He later commented on the lack of effectiveness of the plant's secondary emissions control system. "The haze inside the potrooms sort of drifted and hung, like it wasn't being sucked out very forcibly. That was not the case at Goldendale. The draft was quite substantial, and there wasn't that hanging of the haze in the potroom," Zeh said. "Well, it made me wonder for a while whether the roof fans were even on. Later in the day, we found out that they were on, but there still was not the movement of air in the potrooms at The Dalles as there was at Goldendale." The plant's chief engineer, George Youngmeister, testified in the Orchard View Farms v. Martin Marietta Aluminum trial in 1977 that he didn't know why the company hadn't installed a forced-draft tunnel control system before 1970. The design was not "exotic," he said. "We just didn't think of it." There were other problems with the rooftop wet scrubbers, especially during colder months. From 1963 through 1970, the plant did not operate the wet scrubbers in November through February because they might freeze. The low efficiency of fluoride removal in tests during the mid-1960s also was attributed to improper maintenance – clogging of the water spray nozzles and the screens by tar and dust from the potroom air hampered their operation. [64]

The overall effectiveness of the Harvey smelter's emissions control was criticized during the Orchard View Farms trial. Barney McPhillips, the former chairman of the Oregon

Environmental Quality Commission, stated that fluoride emissions from the smelter could have been limited to one pound per ton of aluminum produced, but starting in 1965, the company had not voluntarily minimized its emissions to the fullest possible extent. Richard Hatchard, the chief of the Oregon air pollution control office in the Oregon Board of Health and State Sanitary Authority during 1952 to 1964, said damages incurred during the 1958 to 1973 period were "unnecessary… because adequate controls were not installed." Hatchard added, "I have every confidence that if they sought the services of an experienced design firm, that a system could have been designed and installed in The Dalles in 1961." The emission control systems that were eventually installed at the smelter subsequent to the 1965 to 1971 claim period in the case "were available for many years before the plant came into existence," Hatchard said. [65]

After 1975, the plant's owners began to consider purchasing Sumitomo aluminum-smelting technology – the same equipment being installed at the Anaconda Aluminum Co. smelter in Columbia Falls at that time. An order was placed in March 1977, and the technology was expected to be implemented at the plant by the end of 1979. Raymond Rooth, a designer of pollution control systems for aluminum plants for Norsk Viftefabrikk Co., testified in the Orchard View Farms trial that the Japanese claimed 90% collection efficiency for the Sumitomo system when used on vertical-stud Soderberg cells. Joseph Byrne, the smelter's environmental control officer through the 1960s, testified the efficiency would be about 95%. The Sumitomo technology was expected to maintain better heat balance and cell stability by closely controlling alumina feed, which would keep the cathode clean and the side freeze from intruding under the anode and obstructing the passage of electric current, it was explained in court. [66]

Failing to install proper equipment was only half the story at The Dalles – plant management also tried to deceive emissions tests. On Nov. 11, 1964, Harvey reported fluoride emissions at The Dalles of about 640 pounds per day, or about 2.5 pounds per ton of aluminum produced – which was about half the 1,300 pounds per day the company had stipulated to emitting in 1963. Joseph Schulein, a chemical engineering professor at Oregon State University for 17 years, testified in the Orchard View Farms trial that when he learned about the report, he decided to investigate the matter by checking the plant's potline power consumption during the time of the emission tests and during the months immediately preceding and following each test. When he asked to see the plant's power-use charts, he testified, company comptroller Fred Blatt told him that no such records were kept. According to U.S. District Court Judge James M. Burns in his ruling in the Orchard View Farms case, Byrne attributed this recalcitrance to Blatt's "delusions of grandeur" in his self-appointed role as "superspy 007." [67]

After later obtaining the charts through Harvey's legal counsel, Schulein discovered that during the two-hour period when the emission tests were conducted, "there were considerable periods when the voltage was so low it was off the charts." He couldn't find another period of time with a similar voltage. Schulein reasoned that the low potline voltage would have cooled the reduction pots and hardened the crusts, thereby reducing fluoride emissions in the pot rooms and diverting most of the emissions to the primary control system. The plant's chief operator later confirmed that power to Potlines 1 and 2 had been shut off at times during the emissions tests because plant power crews were conducting a capacitor test that had been planned a few days in advance. The chief operator said he had received no notice that fluoride emissions were going to be measured that same day. Schulein concluded that the emission control system at the plant could not have achieved the 640 pounds per day result if the plant had been operating at full power. [68] In his 1973 account of the case, William H. Rodgers Jr. wrote, "Turning off the power turns off the fluorides. It was done intentionally. Harvey Aluminum doesn't pay claims or control fluorides willingly." [69]

Raymond Rooth also questioned the accuracy of emission tests conducted by staff at the Harvey smelter. He said the plant's reported average emission of 2.5 pounds of fluoride per ton of aluminum metal produced in November 1964 was within the range he would have expected, but he noted that he had no great confidence in the plant's short-term measurements as an accurate indication of its long-term average emissions. He also expressed skepticism over the company's 1974 report to the Oregon Department of Environmental Quality, which claimed the smelter was emitting only an average of 0.68 pounds per ton. Harold Zeh testified in Orchard View Farms that Martin Marietta could have reduced the amount of fluoride emitted by the reduction cells by increasing the bath ratio to 1.45 to 1.50 and decreasing the amperage to 91,000 to 92,000 amps. A bath ratio of 1.50 would emit 50% less fluoride than a ratio of 1.25, he said. [70]

Using a higher bath ratio and lower amperage could have impacted production numbers, a consideration that emerged in testimony. Lars Ryssdal, a Norwegian who had worked previously at the AAC plant in Columbia Falls, was plant superintendent at The Dalles from 1964 to 1970 and plant manager from 1970 to 1972. He defended the plant's use of lower bath ratios of 1.25 to 1.30 – it allowed the company to operate the cells at lower temperatures despite the higher amperage of 102,000 to 107,000 amps used at the plant from 1965 through 1971, he said. Ryssdal conceded, however, that increasing the bath ratio to 1.40 and reducing amperage could have reduced fluoride emissions. Overall, Judge Burns was not persuaded by Ryssdal's argument in his 1980 opinion in the Orchard View Farms case. "A reduction in the plant's productive capacity

is no less a cost of pollution control than the capital and operating expenses of emission control devices," Burns said. [71]

Information about air pollution control technology used at other aluminum smelters with vertical-stud Soderberg reduction cells was introduced as evidence in the Orchard View Farms trial. That evidence included the Reynolds-Hamburg prebake plant, the Ardal og Sunndal Verk Sunndalsora plant and smelters operated by Alcoa and New Zealand Aluminium Smelters Ltd., all of which installed a computerized continuous-emission analyzing system in the 1970s; the Pechiney plant in Saint Jean de Maurienne, France, the Montacatini plant in Italy and various Alcoa plants, all of which attempted to hood vertical-stud Soderberg reduction pots with varying success in the 1950s and early 1960s; the Hytte-Rheinfelden plant in Norway, the Pechiney plant in Noguerre, France, the Ardal og Sunndal Verk Ardal plant in Norway, the Sunndalsora plant in Norway, and the Mosjoen Aluminiumsverket plant in Norway, all of which installed wet-type electrostatic precipitators in their primary emissions control system in 1959 through 1971; the Graenges-Sundsvall plant in Norway and the Ardal og Sunndal Verk-Ardal plant in Norway, which installed dry-type electrostatic precipitators and baghouses in their primary emissions control systems in the early 1970s; the Pechiney plant in Noguerre, France, the Hytte-Rheinfelden plant in Norway, the Mosjoen Aluminiumsverket plant in Norway, the Graenges-Sundsvall plant in Norway and the Alnor-Karmoy plant in Norway, all of which began using a forced-draft system to direct potroom emissions to secondary emissions control systems from 1959 through 1970; and the Reynolds smelter in Troutdale, which used a wet scrubber and forced-draft system to control emissions at its prebake anode plant. [72]

Ag station studies

Early baseline conditions at The Dalles were established in 1953, five years before the aluminum plant began operating, by the Oregon State University Mid-Columbia Agricultural Experiment Station, which began to measure fluorine content of vegetation within six miles of the future smelter site. The ag station continued to survey fluorine content in vegetation in the same area twice during each growing season from 1957 through 1967. The average fluorine content increased from 7.9 ppm in 1953 to 64.8 ppm in October 1958, soon after the smelter began operating. An ag station survey in 1959 found soft suture in peaches "not observed previously in this area." The average fluorine content continued to increase, spiking at 196 ppm in September 1960 before falling to a range of 6.4 ppm to 21.6 ppm from July 1963 through September 1967. Sampling sites within one to two miles of the smelter plant were much higher, hitting a high of 176 ppm in October 1962 and settling into a range of 9.6 ppm to 21.6 ppm in July 1963 through September 1967. [73] In 1960, ag station researchers O.C. Compton, L.F.

Remmert and W.M. Mellenthin reported on fluorine levels in crops near The Dalles before and after the Harvey Aluminum smelter went into operation there. They found that before the smelter began operating, fluoride concentrations in plants within two miles of the plant averaged 6.4 ppm, but the average increased to 113 ppm after the plant had been operating for four months. [74]

Researchers at the ag station also conducted experiments by spraying a solution of ammonium fluoride on 10 Royal Ann cherry trees 12 miles from the plant site. In April 1962, the Wasco County Fruit and Produce League reported on the ag station's experiment by stating that a 50 ppm ammonium fluoride spray reduced cherry pollen viability and, when applied to female flower parts, reduced cherry fruit set by more than 50% and decreased individual cherry fruit weight. In 1961, ag station researchers surveyed one-year-old pine tree needles at 13 sites from one to four miles from the Harvey smelter and at one site in Hood River, about 20 miles west of the plant. The researchers specifically discounted any connection between the "scorching" injuries to the trees and insects or soil conditions. "There was no pathological, entomological, or soil condition that would account for the needle scorch found in the area," they said. Instead, the researchers attributed the injury to exposure to fluorides. During a 1961 tour of the pine groves, Oregon state pollution control administrator Richard Hatchard reported seeing "considerable damage to the needles, which presented a dying tree appearance." In the spring and summer of 1963, ag station researchers monitored the concentration of hydrogen fluoride in the air around three orchards near the Harvey smelter and found it to be substantially higher than the amount measured by the company at its own test orchard. Over the next few years, ag station researchers expanded their ambient air quality monitoring to additional orchards around the smelter site and found the hydrogen fluoride levels to be higher than at the company's own orchard. [75]

In August 1960, the Wasco County Fruit and Produce League complained in a letter to Harvey that fluoride emissions from the company's smelter at The Dalles were causing "severe damage to the fruit set, fruit and foliage of our cherry trees." According to the League's letter, "This year the general pattern of production showed that the farther away from Harvey Aluminum plant our cherry orchards were located, the better was our production... Most of the distant orchards had a good crop while those close in generally had less than half a crop. The district was short of a normal crop by several thousand tons with the resultant loss in value of approximately $1,000,000. Some of the fruit from orchards near your plant which was picked up for canning, in a fully ripe condition, showed suspicious symptoms. This consists of a blossom end deformity and withering of the fruit. In addition to this, we are receiving a substantial amount of marginal leaf burn and a rolling and drying of the foliage. We feel this will have a

definite adverse effect on our cherry crop the next year." In December 1960, the League presented to the Oregon State Sanitary Authority an analysis showing that the 1960 cherry crop was reduced to one-third of the 1958-1959 harvest at orchards where the cherry leaf fluorine content was at least 60 ppm. Meanwhile at orchards four to six miles from the smelter, where the cherry leaf fluorine content was less than 60 ppm, the crop was at 102% of the 1958-1959 harvest. [76]

Joseph Byrne, the environmental manager at Harvey Aluminum through the 1960s, was hired in 1961 to evaluate the claims by owners of area fruit orchards. Byrne often worked with outside consultants hired by Harvey or Martin Marietta to inspect the orchards. In 1961, he concluded that the marginal chlorosis in cherry leaves seen around The Dalles was caused by a manganese deficiency. Damage to fruit trees in fumigation experiments by researchers at Washington State University and the Mid-Columbia Agricultural Experiment Station were the result of "substantially high levels" of fluoride, he said. In 1965, Byrne observed damage to various fruit trees in the area of the Harvey smelter but said he did not believe it was caused by fluoride exposure. Even after plaintiffs in the Orchard View Farms case were awarded $88,135 in 1973, Byrne testified in the same case that he had never seen damage to cherry trees caused by fluoride emissions. Harvey Aluminum plant manager Taylor Gibson testified later that "the most competent scientists available to us… uniformly report that any unusual symptoms observed in the orchards are not caused by emissions from our plant." [77]

In 1980, Judge Burns stated in his ruling in the Orchard View Farms case that evidence from other scientists, combined with the frequent complaints of the orchard owners, "renders disingenuous Byrne's claim to a well-founded and sincere belief that the plant's emissions never damaged cherry crops in The Dalles." At one point, Judge Burns noted in his opinion, Byrne met with the orchard owners and Mid-Columbia Agricultural Experiment Station researchers to propose a "comprehensive evaluation of The Dalles cherry growing area," but the orchardists rejected the proposal because they felt "there were too many strings attached." Even after he was aware of the orchardists' continued complaints and the results of U.S. Department of Agriculture inspections in 1965 and 1966, in addition to inspections by Harvey's hired consultants in 1967, Byrne still concluded that fluoride injury to peaches "hasn't been a substantial problem since about 1963," Judge Burns noted. When pressed at trial in the Orchard View Farms case, Byrne's admission that only "a single peach" may have had soft suture in the 1965 to 1971 claim period "strained" Byrne's credibility, Judge Burns noted. "As with cherries, I find the company's efforts to ascertain what harm the plant's emissions might be causing to peach crops in the vicinity to have been less than diligent and the company's reaction to evidence of harm produced by the efforts of others to have been obstructionist," Judge Burns said. "The company's attempts to blame what reasonably

appeared to be damage from fluoride upon plant diseases, weather conditions (including wind), soil conditions (including nutrient deficiencies), horticultural practices, insects, pesticides and a lack of water are not persuasive." [78]

Judge Burns also noted that Byrne was aware of the problem of pine blight around the Kaiser aluminum smelter in Spokane prior to his hiring by Harvey in 1961. Byrne's statement that emissions from the Harvey smelter had not harmed pine trees around The Dalles since 1963 directly contradicted findings of a Mid-Columbia Agricultural Experiment Station pine needle scorch survey in 1965, "and in my judgment does not constitute a well-founded and sincere evaluation of potential damage from the plant's emissions," Judge Burns said. When the ag station concluded on the basis of a 1970 fruit set survey that fluoride from the smelter was harming the cherry crop in The Dalles, the company hired a statistician to provide an alternative interpretation of the data. Prior to March 1972, the company began negotiations with the Boyce-Thompson Institute for replication of the ag station's research, but ag station researchers were not invited to participate in the Boyce-Thompson study and were not aware of it until after its conclusion in 1976. "The preponderance of the evidence shows that, before and during the 1965-1971 period, the company was more concerned with denying its responsibility for damage to cherry crops than with accurately detecting any adverse effects from exposure to fluorides from the plant," Judge Burns concluded. [79]

In 1963, U.S. District Court Judge John Kilkenny for the District of Oregon issued his decision in Renken v. Harvey Aluminum. A group of plaintiffs alleged that air pollution from the Harvey smelter damaged their cherry, peach, prune and apricot trees. The effect of fluorides on vegetation had been well described in an earlier case, Fairview Farms Inc. v. Reynolds Metals, decided by Judge William East in 1959, but the Harvey plant used vertical-stud Soderberg pots, and the Reynolds plant in Troutdale used prebake cells. Harvey's cells were partially hooded, so 80% of the pot gases were collected by the primary air pollution control system, and 20% drafted to the rooftop vent as secondary emissions. Both emissions went through a type of wet scrubber system. It was estimated that 300 pounds per day of fluoride were not captured by the primary emissions wet scrubbers. The wet scrubber system in the rooftop vent was installed in 1962, but it was estimated that 1,000 pounds per day of fluoride was not captured by the secondary emissions wet scrubbers. The total fluoride estimated to leave the plant was 1,300 pounds per day. Judge Kilkenny noted that the prevailing wind was southwesterly, but on numerous days there was no wind. "At times, a blanket of smoke from the defendant's plant covers the area, including the plaintiff's lands and orchards," he said. "The blanket was observed by the Court, not only on the day of inspection of the plant, but also on many occasions since that time." [80]

Judge Kilkenny said he wanted Harvey to improve its air pollution control system. "There is no doubt in my mind but that better controls can be exercised over the escape of the material in question," he said. "No sound reason has been advanced by the defendant why hoods, similar to those employed by Reynolds, should not be installed." He agreed with an expert witness that if proper hoods were installed, the little amount of fluoride escaping the plant "would be inconsequential." Judge Kilkenny said he also wanted to see electrostatic precipitators installed to capture smaller particulates not already captured by the multi-cyclone dust collectors at the plant. While expensive, he noted, "Such expenditures would not be so great as to substantially deprive defendant of the use of its property." He suggested such costs, if necessary, could be passed on to the consumer. "The heavy cost of corrective devices is no reason why plaintiffs should stand by and suffer substantial damage," Judge Kilkenny said. On the other hand, he was not convinced all the damage to the plaintiff's cherry crops in 1960 was caused by emissions from the Harvey plant, noting that there was a light cherry crop all around the region that year. Kilkenny concluded, however, evidence that emissions from the plant had harmed peach, prune and apricot trees since 1958 was "clear and convincing," and plaintiffs with those trees were owed damages by the defendant. [81]

As to a remedy, Judge Kilkenny looked at other court cases involving air pollution by the Reynolds plant in Troutdale. He noted that in the Fairview Farms case, the judge did not grant an injunction because there was no evidence that the acts or conduct of Reynolds was reasonably certain to be repeated in the future. In the Harvey case, however, Harvey had taken the position that it had done everything possible to eliminate the problem, Judge Kilkenny said, and "the 1962-1963 improvement by Harvey was of not particular significance," referring to the wet scrubbers installed on the rooftop vents. In another case, Reynolds Metals Co. v. Wand, the court ruled in 1962 that Reynolds had spent $2.1 million on air pollution control equipment and there was nothing on the record to show that further emissions reduction was possible. In the Harvey case, Judge Kilkenny noted, Harvey had yet to install better hooding over the reduction cells, similar to those used by Reynolds. In conclusion, Kilkenny said, the plaintiffs had sustained the burden of proof by showing that fluoride emissions from the Harvey plant had landed on their property. [82]

Furthermore, Kilkenny noted, Harvey had failed to abide by a pre-trial order requesting proof that controlling emissions any further would cost so much it would deprive Harvey of use of their property. Harvey's plant manager even said he didn't know how to obtain efficiency records from other aluminum plants, Kilkenny said. While the plaintiffs called experts that explained how emissions could be reduced, "the defendant made no attempt to carry the burden of going forward with the evidence." Judge Kilkenny summed it up by saying, "Frankly stated, there is no good reason why the defendant

company, like other companies similarly situated, should not make a reasonable expenditure in the erection of hoods, or like devices, over or around its pots or cells. To require less would be placing a premium on air pollution. What's good for Reynolds should be good for Harvey, even though the cost of the new system might exceed $2 million, as it did in the case of Reynolds." Judge Kilkenny also noted that Harvey's claim that Oregon's air pollution laws pre-empted a civil case was wrong because Oregon law recognized the right of individuals to prosecute a suit to abate a private or public nuisance. He also recognized the air pollution problem across the U.S., citing the Air Pollution Control Act of 1955 and the Clean Air Act of 1963. Judge Kilkenny ruled that Harvey must install proper hoods over its reduction cells and electrostatic precipitators in appropriate places around the plant – otherwise, he would issue an injunction if requested by the plaintiffs. [83]

Witnesses for the defense

Expert testimony for Harvey in the Renken case was provided by the Boyce Thompson Institute. The institute claimed it was formed to study plant life for the benefit of mankind, but it initiated a fluoride study for Alcoa in 1951. By 1963, during the course of the Renken lawsuit, it became clear that the institute received grants from aluminum companies, including Harvey. In 1970, during the Meyer vs. Harvey Aluminum Inc. trial, it came out in testimony that the institute had received $200,000 a year from Harvey in 1963. [84] George L. McNew, the managing director of the Boyce Thompson Institute for Plant Research, testified in the Renken case in 1963 that the institute was "a private endowed nonprofit institution devoted to the public welfare" with experts in air pollution and other problems impacting agriculture. On cross-examination by Portland attorney James Morrell, McNew said the institute received funding from fertilizer, oil and phosphate companies, and one aluminum company, and that Harvey Aluminum had contributed to the institute for one or two years. Seven years later, during the appeal of the Meyer lawsuit in 1970, attorney Arden Shenker cross-examined David McLean, who worked for the institute, about funding. McLean said most of the 14 companies that contributed to the institute were aluminum companies. McLean added that the National Air Pollution Control Administration, an arm of the U.S. Public Health Service, and the U.S. Department of Health, Education and Welfare also had contributed to the institute. [85]

The Boyce Institute participated in a National Academy of Sciences panel in 1970 to help the EPA establish air quality standards for fluoride, and it was hired by the Anaconda Aluminum Co. in 1970 to look at Forest Service and Glacier National Park data about fluoride impacts to vegetation and wildlife. Academic institutions were also linked to the aluminum industry. In 1967, Japanese-American vegetable growers in Washington who

were harmed by fluoride emissions from the Harvey smelter were represented by Grant J. Saulie in a letter he wrote to the Washington state government seeking assistance. Saulie was referred to a professor at the Washington State University's engineering research department with extensive knowledge about fluoride problems. The university, however, turned Saulie down, saying they only conducted pure research and would not get involved in a potential lawsuit – such an investigation could cost up to $75,000 and involve numerous specialists, he was told. William H. Rodgers Jr. in his 1973 book "Corporate Country: A State Shaped To Suit Technology" claimed that Washington State University was influenced by heavy industry, including Intalco which needed help researching fluoride emission impacts at its Ferndale, Wash., aluminum smelter. [86]

Lamar Tooze, an attorney for plaintiffs in several aluminum plant air pollution cases, provided a sharp opinion of the Boyce-Thompson Institute in a Sept. 13, 1971, letter to Phil Bolley of Chevy Chase, Md. Bolley earlier had inquired about expert witnesses and Boyce-Thompson in particular. "Boyce-Thompson Institute is a paid, confirmed partisan of the aluminum industry, from which it has, over the last decade, received immense retainers directly related to the industry's hostility to effective pollution controls," Tooze wrote to Bolley. "In its execution of this mission, Boyce-Thompson has maintained close liaison with the industry's legal clearinghouse in Pittsburgh; it has produced numerous publications of a purportedly scientific nature, deprecating the effect of fluorides upon plant and animal life; it has furnished its leading 'scientists' as expert witnesses in the defense of aluminum producers, and it has, directly or indirectly, exerted its prestige and facilities in the activity of official pollution-control agencies." Tooze also claimed the institute had influenced state agencies that were developing pollution regulations. "There is unmistakable evidence that Boyce-Thompson has, directly or obliquely, prevailed upon the environmental-protection boards of Washington, Texas and New York to adopt fluorine standards known to be essentially spurious," Tooze said. [87]

Clancy Gordon, a professor of plant pathology at the University of Montana, testified about Boyce-Thompson during the Meyer v. Martin Marietta air pollution case in October 1973. He agreed under cross-examination that the institute was 70% funded by UNICEF, the EPA and other non-industry groups and only 30% funded by the aluminum and phosphate industries. But Gordon continued to question the credentials of Leonard Weinstein, a scientist at Boyce-Thompson, because Weinstein wouldn't publish the results of investigations of fluoride pollution by aluminum plants. Gordon acknowledged that he spoke with Weinstein from time to time and that his laboratory at the University of Montana had collaborated with Boyce-Thompson. [88]

Orchard View Farms Inc., which operated three orchards totaling about 500 acres between 2.5 and five miles from the aluminum smelter at The Dalles, sued Harvey in

1971. Donald Bailey, his wife and five of their children were the sole stockholders. A jury trial was held in April and May 1973, and Orchard View was awarded $103,655 in compensatory damages and $250,000 in punitive damages. Martin Marietta appealed the judgment on numerous grounds. The Ninth Circuit Court of Appeals affirmed the compensatory damages but reversed and remanded the punitive damages because Judge Burns had admitted evidence of certain events that had occurred before the 1965 to 1971 claims period and which had been insufficiently linked to the company's conduct and policies during the claims period. Judge Burns issued his findings of fact, conclusions of law and opinion in the Orchard View Farms case on March 28, 1980. His lengthy opinion included information about the history of the lawsuit, scientific inquiry about the effects of fluoride on fruit trees and other vegetation, previous fluoride air pollution cases in the Oregon and Washington area, efforts by plant owners Harvey Aluminum and its successor Martin Marietta to control fluoride emissions, investigations by state officials and company-hired consultants, how aluminum smelting cells operated, emission-control technology used in other aluminum smelters, and the Oregon law of punitive damages, especially in terms of societal value. [89]

After reviewing a vast amount of scientific and legal evidence, Judge Burns ruled that Orchard View Farms should receive $200,000 in punitive damages for the claim period through 1968 but not thereafter. "This case is one of an ever-increasing number filed against Harvey, and later Martin Marietta, by orchardists who charged that fluorides emitted from the plant have damaged their crops," he said. The first, Renken v. Harvey Aluminum Inc., was filed in May 1961 and closed in 1966. Between February 1977 and March 1980, thirteen related actions had been filed in U.S. District Court for damages caused by emissions from the aluminum smelter, he said. Judge Burns referenced other air pollution decisions in forming his opinion. "This guidance provided by the Oregon Supreme Court and the Ninth Circuit Court of Appeals, though specific to the context of industrial air pollution, does not define with precision the circumstances justifying the imposition of punitive damage liability," he said. "A broad synthesis of these opinions provides the conclusion that punitive damage awards may be imposed for business activities, harmful to others, carried out in disregard of the corporation's societal obligations. In brief, the issue is whether the defendant has damaged the property of plaintiff by conduct evidencing an 'I don't give a damn' attitude. For a case as complex as this, however, it is important to describe in some greater detail the societal obligations of business enterprises." [90]

Judge Burns cited a 1960 letter from Harvey Aluminum owner Lawrence Harvey to the Wasco County Fruit and Produce League as evidence of the company's awareness of its societal obligations. "In closing I would like to reemphasize our desire to foster the prosperity of the entire community," Harvey told the League. "We are doing, and will

continue to do so, the best scientific job of control that is possible under the circumstances. These are obligations which we consider part of our community responsibility." Judge Burns noted that when a company encounters additional costs, it can shift the costs of production onto others. "In the case of an industrial plant emitting pollution, those harmed by the emissions are, in effect, involuntarily bearing some of the firm's production costs," Burns said. "Our society has not demanded that such externalized costs of production be completely eliminated. Instead, we tolerate externalities such as pollution as long as the enterprise remains productive: that is, producing greater value than the total of its internalized and externalized costs of production. A business that does not achieve net productivity is harmful to society, detracting from the standard of living it is designed to enhance. Because firms can sometimes impose a portion of their production costs upon others, the mere fact that a company continues to operate at a profit is not in itself conclusive evidence that it produces a net benefit to society." [91]

The U.S. legal system does not always operate smoothly when it comes to pollution, Judge Burns said, because the harm may be gradual and difficult to perceive, or because the cause of the harm may be difficult to trace or difficult to link to a pollution source, or because the harm may be inflicted in small amounts upon a large number of people so no single individual suffers sufficient damage to warrant the time and expense of legal action. "Because of these impediments to smooth operation of the tort system and to ensuring that each enterprise bears its own costs of production, the law imposes upon businesses a societal obligation not to obstruct legal procedures designed to provide compensation to persons harmed by externalized costs of production," Judge Burns said. "Enterprises must cooperate with their neighbors in ascertaining the nature, severity and scope of the harm and in arranging to prevent the damage or to neutralize it through some form of compensation. A breach of societal obligations justifies the imposition of punitive damages to deter uncooperative behavior that impedes the legal system from ensuring that enterprises produce a net benefit to society." [92]

Harvey/Martin Marietta did not fail to carry out its societal obligations in every respect, Judge Burns said, but it failed to determine the amount of harm its emissions were causing, failed to control the harmful emissions, and failed to compensate for the remaining harm, all of which supported awarding punitive damages. Judge Burns cited the words of Barney McPhillips, the former chairman of the Oregon Environmental Quality Commission, "who may almost be regarded as the father of Oregon's pollution control progress." McPhillips had determined a change midway through the 1965 to 1971 claim period "in both the attitude of the company and its efforts to carry out pollution control measures so as to behave like a good neighbor." Judge Burns noted that a change in society's attitude that occurred around 1968 was "evidenced by the

movement toward a more careful attention to the earth around us and the necessity of its preservation," which likewise changed laws and regulations. Because of that change, Judge Burns thought it was appropriate to award punitive damages for the portion of the claim period from 1965 through 1968 but not after then. "Because the company did not cooperate in ascertaining the nature, severity and scope of the harm inflicted upon the plaintiff by the plant's emissions or in arranging to prevent this damage or to neutralize it through voluntary compensation arrangements, the company is liable to the plaintiff for an award of punitive damages," Judge Burns concluded. [93]

Emission control in Washington

In 1970, Harvey Aluminum began operating an aluminum smelter on a 7,000-acre site in Goldendale, Wash., on the north side of the Columbia River near the John Day Dam. Martin Marietta purchased the plant in 1971 and operated it until 1985. The facility was then purchased by Commonwealth Aluminum (Comalco), which operated the plant until 1987. The plant was then idle for 1 1/2 years before being purchased and restarted by Columbia Aluminum. The plant was then sold to a private party which operated the plant under the name Goldendale Aluminum Co. The 178,000 ton-per-year plant consisted of a carbon paste plant, four potlines, a casthouse, a laboratory, administrative offices and a sewage treatment plant. The plant had one wastewater discharge outfall that emptied, after treatment, directly into the Columbia River. The plant used vertical-stud Soderberg reduction pots. [94]

In July 1984, fluoride emissions from the Goldendale smelter reportedly damaged peach trees at an orchard near Briggs Junction, about seven miles west of the plant. According to the Washington Department of Ecology, which was notified about the problem in September 1984, the plant had received off-specification coke, which was used to make carbon briquettes for its Soderberg anodes. The anodes did not operate correctly for a long period of time, and the smelter exceeded its permitted fluoride levels. The orchard owner was later compensated by Comalco. [95] From 1988 through 2003, according to the EPA's Toxic Release Inventory and self-reporting by the company, the Goldendale smelter released more than 2,100 tons of aluminum oxide, 1,446 pounds of benzo(G,H,I)-perylene, 335 tons of carbonyl sulfide, 16 tons of chlorine, 257 tons of hydrogen fluoride, 359 pounds of lead and 8,419 pounds of polycyclic aromatic compounds. [96]

In 1952, Alcoa began operating a 100,000 ton-per-year aluminum smelter in Wenatchee, Wash., using prebake reduction cells. By 1956, the Wenatchee plant was producing 220,000 tons per year. The Wenatchee facility was located on the banks of the Columbia River in a river valley about 1.8 miles wide surrounded by bluffs rising to 760 feet above the valley floor. [97] On Nov. 2, 2015, Alcoa announced it would shut down

operations in Wenatchee. Overall, Alcoa planned to curtail 503,000 tons of aluminum smelting capacity and 1.2 million tons of alumina refining capacity across the U.S. [98] Alcoa shut down operations at the 64-year-old smelter in January 2016. [99] New technology to improve reduction cell performance and pollution control was tested over the years at the Wenatchee facility. In 1954, Alcoa was the first aluminum producer to begin testing higher concentrations of aluminum fluoride in aluminum reduction cell bath. Work at Wenatchee showed that higher concentrations could improve current efficiency. Alcoa first tested point-feeding technology at its Wenatchee smelter in 1958. [100] Alcoa also installed a unique recirculation system at the Wenatchee smelter that routed waste stream gases from reduction pots back through the pots prior to entering the pollution control system. This pollution control system consisted of a scrubber in series with an electrostatic precipitator. [101]

According to a BPA final environmental impact statement in 1985, the Wenatchee smelter annually discharged 74.84 tons of fluoride in the Columbia River. [102] On May 9, 2007, Washington Department of Ecology announced it had fined Alcoa Wenatchee Works a total of $22,750 to for violating air pollution limits at the Wenatchee smelter. The aluminum plant was required to check its air quality protections on a quarterly basis. In May of 2006, during what was called an “emissions source test,” particulate matter released from the operation was 28% higher than the limits allowed in the plant’s air operating permit. [103] According to a March 2010 Washington Department of Ecology support document, Alcoa said it could not have prevented the violation through carefully planned or improved design. In response to the violation, the company spent $250,000 installing finer-mesh bags and adjusted pulse rates for the baghouses used in the dry scrubber system. At the time, the Wenatchee smelter’s prebake cells were hooded, with primary emissions directed to an alumina-injection dry scrubber system. To meet ambient and forage fluoride standards, plant emissions were limited to 327 pounds of gaseous fluoride per day averaged over 12 months. Emissions from the anode bake oven were treated by the same primary emissions dry scrubber system. A separate coke-injection dry scrubber system was used to treat the green mill for anode production. [104]

In 1966, American Metal Climax (Amax) and Howmet, the latter controlled by Pechiney, joined forces to build a new smelter called Intalco on Puget Sound in Ferndale, Wash. Using Pechiney’s high-capacity and highly automated potlines, the new smelter was rated at 260,000 tons per year. [105] Alcoa’s 2015 plans to reduce its aluminum smelting capacity in the U.S. by 503,000 tons included stopping production at the Intalco plant. [106] In May 2016, however, Alcoa announced that a new power agreement with the BPA along with $3 million in Washington State funding would stop the Intalco smelter from

closing in June. [107] With a new power contract, Alcoa announced, the Intalco plant would stay open until Feb. 14, 2018. [108]

The Intalco smelter went into operation in 1966 with a kick-off pledge by the company that it had "spared no expense in efforts to control pollution," according to William H. Rodgers' 1973 book. But the company was allowed a five-year delay in the installation of its primary treatment plant for wastewater discharge. By 1971, a marked deterioration of water quality was detected in an area of more than four square miles around the plant's wastewater outfall. The company also illegally diverted millions of gallons of wastewater by ditch to a natural drainage that flowed over a bluff and across state-owned tidelands, according to Rodgers. The bluff eventually eroded, depositing 300,000 cubic yards of earth on the beach. While operating in those first years, the Intalco plant emitted 800 pounds per day of hydrogen fluoride and 15,000 pounds per day of particulates, which impacted local cattle. [109]

In 1971, when Intalco came to BPA requesting a change to its firm power contract, Interior Department regional representative L.B. Day wrote to BPA Administrator H.R. Richmond recommending that the agency withhold a power sales agreement until Intalco proved it was addressing pollution concerns. The Interior Department's Bureau of Sport Fisheries took an even stronger stance, calling Intalco's air and water pollution control equipment "either inadequate or nonexistent." Intalco wrote to the BPA promising that it would meet Washington State water pollution standards and spend $14 million more to control air pollution. Several days later, Intalco was awarded its power contract. A BPA representative testified about the Intalco situation to the U.S. House Subcommittee on Conservation and Natural Resources during a hearing on "Protecting America's Estuaries: Puget Sound and Juan De Fuca" in 1971. Richmond explained the BPA's reluctance to crack down on Intalco during the initial five year period in a Nov. 24, 1971 BPA memo. "Specifically, we were not informed by (the state agencies) of any official complaint having been received relative to Intalco's operations," he said. His explanation did not take into account documented damage and a dozen pending lawsuits, according to Rodgers. [110]

From 1971 through 1977, J.R. Newman and J.J. Murphy studied the effects of fluoride emissions from the Intalco smelter on black-tailed deer common to the coastal area's mixed habitat of conifer and broadleaf woodlands, dairy farms and pastures, residential areas and industrial parks. The deer utilized in the study were collected from road kills or illegal hunting by the state game department. Three pathways to fluoride contamination in deer were described – inhalation of airborne fluoride, drinking water with high concentrations of fluoride, or ingestion of vegetation with heavy concentrations of fluoride. Concentrations in water sources were not high because of

continual rainfall, so vegetation was considered the primary pathway. To study contamination of the food chain, a two-year browse study was conducted. The study found fluoride concentrations to be quite high in the five major browse species – even above the 40 ppm standard recommended for livestock. Fluoride concentrations in deer which came from within three miles of the smelter ranged from 638 ppm in a nine-month-old fawn to 5,426 ppm in a male deer older than two years. These levels were similar to the levels found in mule deer and white-tailed deer that lived near other industrial fluoride sources. Symptoms of fluorosis were similar to that found in cattle, including extensive dental disfigurement and excessive tooth wear. Deer with fluoride concentrations of at least 2,000 ppm had thickened leg bones with chalky white, roughened surfaces. One humerus had a 0.6 cm long bone spur. [111]

Humans living near the smelter also were impacted. On March 13, 1972, a jury decided in favor of Paul G. Barci and his son Paul N. Barci in their lawsuit against Intalco. The Barcis claimed fluoride emissions from the smelter plant had damaged their cattle and trees and their own health. A lung specialist testified that the father suffered from pulmonary fibrosis, a permanent lung disease that had disabled him. Two years later, in 1974, Intalco lost a $130,500 fluoride air pollution lawsuit brought by Ray and Helen Freeman, who lived a mile away from the plant. [112] In the Freeman case, Clancy Gordon was deposed as an expert witness for the plaintiffs in 1973. When asked if he had described some areas in the U.S. as “ecological disaster areas,” he replied yes and cited the areas around the silver mining town of Kellogg, Idaho; the aluminum smelter in Columbia Falls, Mont.; the Stauffer Chemical plant near Butte, Mont.; the smelter city of Trail, B.C.; the Kennecott Copper smelter near Salt Lake City, Utah; two smelters operating near Hayden, Ariz.; and the ASARCO smelter near El Paso, Texas. Gordon told the court that the area around the Intalco aluminum smelter in Ferndale, Wash., was not yet an ecological disaster area. [113]

On April 3, 1972, Paul N. Barci wrote to Clancy Gordon saying he would send $1,000 toward getting investigative work done for the air pollution case despite the financial losses at his farm. He thanked Gordon for his work and described the harmful health effects of the air at his home. “I have to get Anna Marie and the baby out of the area immediately, as the baby is showing definite signs and symptoms of being affected with the same type of thing as I and a great many of other people in the surrounding territory are affected with,” Barci wrote. “I am in the middle now of getting Anna Marie and little Rosie to go to Italy, where they will remain until this thing is settled and we are able to move out of there. It simply is unbearable and unwise for any child, or grownup for that matter, to attempt to survive in an atmosphere such as prevails in our area.” [114] In 1976, Barci v. Intalco Aluminum Corp. was heard in Whatcom County Superior Court in Bellingham, Wash. Experts testified that fluoride concentrations in grasses near the

smelter ranged from 10 ppm in early summer to 146 ppm in late summer. [115] In another air pollution lawsuit, Anderson v. Intalco, Joe Pemberton, a plaintiffs' attorney from Portland, Ore., learned that one of Anderson's cows had died and Paul Barci had shot a movie of the cow before it died. A memo between unspecified attorneys in the case included a poetic memorial for the dead cow titled, "Camile Cud, an elegy." It began, "Those happy gambols on the lea, where grass and pecker joined / In lactation and maternity – by foul fumes purloined. / So full was she of acid, mainly potent hydrofluoric, / That the bull became quite flaccid and his column turned to Doric." The poem concluded, "In the joy of her reward, she collapsed upon the sward, where Intalco's' poison fume sealed her quite ecstatic doom." [116]

Gordon utilized aerial infrared photography in the Barci v. Intalco air pollution case to determine the impacts of fluoride emissions from the smelter on surrounding vegetation. Don Dodge, an anthropology student who graduated from the University of Montana in 1967, handled the cameras and the infrared film and did the processing for Gordon's investigations. [117] Lamar Tooze, the Portland, Ore. attorney representing the plaintiffs, referred to the aerial reconnaissance in a colorful letter sent to Intalco's attorneys Richard Allen and Richard Fleeson requesting discovery documents and that Intalco pay Gordon for his laboratory analysis work. "Dear Dicks," Tooze wrote. "I have devoted a sincerely evil nature, inflamed by monetary loss, to getting mad at you birds, but I remain friendly, a mark of defective character." Tooze requested certain laboratory results and "human pee records" and warned that aerial reconnaissance of the Intalco plant would continue by his "brindle tan color" airplane which "is stealthier than an owl, and you will never know when, silent and invisible in the crap over the plant, the deed will be committed." [118] During court testimony, however, Gordon was asked if he was familiar with Paul Miller, a plant pathologist at the Corvallis Experimental Station in Oregon. When Gordon replied in the affirmative and mentioned Miller's use of infrared photography, Richard Allen noted that Miller "has now abandoned the use of infrared as a technique for damage to trees." Gordon said he wasn't aware of that. [119]

Intalco's attorneys took a hard line on Gordon during depositions and testimony. When Gordon testified on the stand in federal court in Seattle in the Barci v. Intalco case on Feb. 28, 1972, much of the questioning was about Gordon's professional credentials. Gordon said his first work on fluoride pollution was in 1957 and involved Kaiser's Mead aluminum smelter near Spokane, Wash. That investigation was led by C. Gardiner Shaw. Gordon said he also investigated fluoride pollution around Garrison, Mont., in 1964 at the request of the Montana Board of Health and later by the Environmental Control Protective Agency, an agency which ceased to exist in 1967. He next investigated the environment around the ASARCO smelter in East Helena, Mont., in 1968 for the

Montana Board of Health and the National Air Pollution Control Administration, the predecessor to the Environmental Protection Agency. [120]

In 1969, Gordon testified in the Barci case, he began to look into fluoride pollution by the Anaconda Aluminum Co. plant in Columbia Falls, Mont., and air pollution by the Mount Storm power plant in West Virginia. He said he worked for the EPA and then the Interior Department for the AAC case. Upon cross-examination, Gordon said he was not a member of any U.S. or Canadian botanical society, or the Air Pollution Control Association, or the American Society of Phyllopathology. He said he was a member of the Western International Forest Disease Society, and that he ran for the Missoula City Council twice in the mid-1960s and for the Montana Legislature once in 1968. When questioned about belonging to other professional societies, Gordon noted that to join some of them, one merely had to subscribe to their journals, which was in some cases handled by the University of Montana or his department. Intalco attorney Richard Allen also asked Gordon about a meeting in Helena, Mont., on Dec. 16, 1971, that was covered by a local newspaper. Gordon reportedly said, "There are some industries which will eventually have to be reduced drastically. One is the aluminum industry in the northeast part of the United States. There will be literally thousands and thousands of men thrown out of work." Gordon said the quote was taken out of context. "That's what the reporter put down in the paper," he noted. [121]

Smelter emissions at Intalco also affected plant workers. On July 27, 1992, Washington State Appellate Court Justices Susan Agid, Rosselle Pekelis and Faye Kennedy ruled in favor of three workers who claimed they were disabled by unhealthy working conditions at the smelter. Justice Agid wrote the decision. James Snydar, Ted Oppewall and Robert Walker had filed accident reports with the Washington Department of Labor and Industries on Aug. 11, 1983, claiming they had sustained an occupational disease caused by working in the smelter. The department rejected their claim in July 1984, citing the Industrial Insurance Act. The three appealed to the Washington Board of Industrial Insurance Appeals, and on April 18, 1986, the industrial appeals judge ruled that all three claims should be allowed, agreeing that their occupational diseases were caused by poor air quality in the Intalco potrooms. Intalco appealed the board's decision to Washington Superior Court, asking for summary judgment by arguing that the three claimants' medical evidence was insufficient as a matter of law to support the board's award of compensation. The trial court denied both of Intalco's motions, and a jury returned a verdict in favor of the claimants. [122]

Each of the claimants had worked at least 12 years at Intalco. Oppewall and Walker began working as potmen in 1966 and 1967 respectively. Snydar began working at the plant in 1966, assigned to cleaning air pollution control equipment above the potrooms.

When Intalco began operating, there was no primary emission control system and no hoods over the pots. Prior to 1972, the only control system in place was a wet scrubber system in the roof of the buildings for secondary emissions. The wet scrubber system cleaned potroom emissions before they left the building but after the workers were exposed to the pot fumes. Oppewall testified that working conditions were "so dusty and gassy at times that he could not see 100 to 200 feet in front of him," Judge Agid wrote. The potmen were also responsible for cleaning their work area after each shift and were covered with carbon and ore dust by the end of the day. Intalco began installing hoods over the pots in 1972, which diverted the pot fumes to a dry scrubber system. However, Judge Agid noted, the hoods were open when work was being done on the pots, exposing the potmen to fumes. [123]

Intalco took an unusual approach to the case by using an expert to describe all the different types of hazardous substances that could be present at the smelter and then claiming that the three workers hadn't provided a good scientific explanation for which hazardous substance caused their injuries. Intalco presented testimony by Arvin Apol, an industrial hygienist with the National Institute for Occupational Safety and Health. NIOSH had conducted an air pollution survey of gases and particulates in the Intalco plant in 1973 while the company was installing hoods over the pots. Apol testified that the air in the potroom without the hoods was twice as dirty as the air in the potroom with hoods. The survey found that the threshold limits for fluoride emissions was exceeded in both the hooded and unhooded potrooms. But NIOSH did not measure all the chemicals present in the potrooms, including aluminum particulates. Apol testified that numerous toxins, including aluminum, benzene solubles, petroleum pitch volatiles and carbon monoxide, also would be present in the potrooms. Apol also testified that carbon monoxide and petroleum pitch volatiles had been associated with neurologic disease. [124]

All three men suffered some type debilitating neurologic disease. In April 1982, Snydar went to Harborview Hospital in Seattle for an evaluation after he had experienced for several years increasing difficulty with coordination, trembling in his upper extremities and unsteady gait. Dr. Linda Rosenstock's preliminary assessment was that Snydar suffered from an atypical neurologic disease. Walker complained of similar symptoms when he, too, went to Rosenstock – generalized weakness and problems with balance. Another doctor had diagnosed Walker's problem as amyotrophic lateral sclerosis, or Lou Gehrig's Disease, but Rosenstock disagreed. Oppewall also went to see Rosenstock. He was less ill than the other two men, but still suffered similar symptoms. Seeing three men with similar symptoms who had worked at the same place was unusual, and Rosenstock referred them to a neurologist at the Pacific Medical Center for a more detailed evaluation. Dr. William Longstreth found that in addition to coordination,

balance and tremor problems, the three men also suffered from impaired cognitive functioning. [125]

At trial, Intalco's attorneys questioned Longstreth about whether those symptoms could be caused by something else, such as Oppewall's episode of meningitis in 1977 and Walker's diagnosis at age 13 of having St. Vitus' Dance, a neurologic condition that eventually went away. The Intalco attorney also noted that Snydar had a significantly lower IQ than the other two men. Both Rosenstock and Longstreth had determined that the three men's neuropathological process affected their central, not peripheral, nervous systems, and based on that evaluation had eliminated from consideration numerous non-work-related causes. Intalco's first argument in the appellate court was that Rosenstock and Longstreth had not made a definitive diagnosis. The appellate judges disagreed. Intalco next argued that Rosenstock and Longstreth had not identified which specific toxic agent or agents had caused the claimants' disease. The appellate judges disagreed, saying the medical testimony established a sufficient basis for Rosenstock's and Longstreth's conclusion that some toxin or toxins in the potroom air had probably caused the claimants' disease. Furthermore, the appellate judges said, Intalco had not provided legal authority for the proposition that the claimants had to identify the specific causative agent. Intalco next argued that the claimants' evidence was insufficient because no other studies of neurologic disease and aluminum workers existed that proved the medical experts' testimony that aluminum was the causative agent. The appellate judges disagreed. They noted that Apol, from NIOSH, had testified that every year the medical profession discovered new diseases that were occupationally related, and that Rosenstock had testified that the lack of reported cases of neurologic disease among aluminum workers did not mean that they did not exist. [126]

Judge Agid agreed with Rosenstock, noting that, "If this court were to accept Intalco's argument, the first victims of any newly recognized occupational disease would always go uncompensated." Judge Agid concluded that a cause-and-effect relationship need not be clearly established by animal or epidemiological studies before a physician could testify that the cause-and-effect relationship existed. The appellate judges disagreed with Intalco's argument that the trial court jury should have been instructed that aluminum could not have caused the claimants' disease because of insufficient evidence proving that cause-effect relationship. The appellate judges also disagreed with Intalco that the trial court jury should have been told to distinguish between the "average" worker and the three particular men in the case in terms of determining a safe exposure threshold limit. The judges ruled that all the claimants needed to prove was that exposure to potroom fumes caused their illness. Intalco had presented testimony by Dr. James Hughes, the medical director for Kaiser Aluminum, who said he had never observed neurologic symptoms similar to those of the three claimants among the 3,000

potroom workers in his company. In rebuttal, the claimants called two of their former co-workers, who testified that they had observed other workers at Intalco with similar symptoms. [127]

By 1991, the 295,000 ton-per-year Intalco smelter operated on a 1,200-acre site on the Strait of Georgia that included an all-weather deep-water port for ocean-going ships delivering alumina. Pot gas emissions from prebake cells were treated in a dry scrubber system. Wet scrubbers treated secondary potroom gases, using 180 eight-foot diameter reinforced plastic fans, each with 80 high-pressure water-spray nozzles that washed 120,000 cubic feet of potroom air per minute. The water was recycled, and the extracted solids were returned to the pots. The prebake plant could produce 1,500 anodes per day, which lasted about 26 days at full production. [128] On April 15, 2004, the Washington Department of Ecology issued a support document for Intalco's air operating permit. The main emissions from the green carbon plant were dust smaller than 10 microns and polycyclic organic matter from the petroleum coke and hard pitch used to make anodes. A dry-coke injection dry scrubber system was used to clean the air from the green carbon plant. An alumina-injection dry scrubber system was used to clean the air from the baked carbon building. All aluminum plants in Washington were governed by state law with additional "gap filling" requirements. The Intalco plant had a satisfactory operating and maintenance program for its air pollution control equipment, the department noted, with functional testing every week. Intalco was required to monitor ambient fluoride and forage standards at 10 sites during the March-October growing season. [129]

Aluminum smelters were not the only businesses emitting harmful fluoride in the Pacific Northwest region. On Aug. 25, 1961, W.S. Meader and his wife May of Pocatello, Idaho, won a $57,295 judgment in the U.S. Court of Appeals for the Ninth Circuit against the Food Machinery and Chemical Corp. and a $4,246 judgment against the J.R. Simplot Co. The Meaders alleged that the two companies' plants emitted solid and gaseous fluoride compounds that seriously damaged the couple's trout farm and fish hatchery. They alleged fish did not hatch properly, and the fish had malformations. During one week after rains fell in the area, the Meaders reported hauling away a ton of fish per day. Fluoride levels in the water samples from the hatchery ranged from 0.5 ppm to 4.7 ppm – the same amount found in food and drinks consumed regularly by humans. [130]

Industrial air pollution was a common occurrence in much of Europe and North America through much of the 20th century and increasingly so in underdeveloped countries by the 1960s. Industrial air pollution in Montana presented major impacts in some areas by the 1880s and over the next century, and included emissions from mining and metal processing plants, timber mills and pulp plants. The problem with these emissions was

made worse in the western portion of the state by mountain valleys that created atmospheric inversions. Compounding efforts to deal with air pollution that harmed both residents and the environment was the overwhelming political influence of the Anaconda Company.

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