Chapter 38

The big conversion

When the Anaconda Aluminum Co. was granted a variance from Montana's fluoride emissions regulations, a compliance schedule filed on July 31, 1974, gave the company about five years to reduce its emissions to required levels. AAC General Manager Charles Taylor told the Montana Board of Health on Aug. 12 that he expected the Foamator wet scrubbers would be installed along the rooftop clamshell vents on the 10 potrooms by the middle of 1979. But after two years of putting the specialized wet scrubbers to the test, AAC abandoned them and at last turned to a costly rebuild of all 600 reduction pots and the installation of a new dry scrubber system for its pot gas emissions. The new reduction pots would not only improve power usage, but they would reduce secondary emissions in the potrooms that ended up venting through the rooftops. Two big dry-scrubber systems would replace the smelter's 30 wet scrubbers, which had been treating primary emissions from the reduction pots since the AAC plant went into operation in 1955. Lower emissions in the potrooms by use of modified reduction pots and more efficient pot gas treatment by the dry scrubbers would, the company hoped, help the smelter achieve state standards without having to convert the plant from Soderberg pots to prebake pots – a prohibitively expensive modification.

By 1970, with evidence of fluoride pollution by the AAC plant growing and the Anaconda Company facing dozens of lawsuits, one of the first steps taken by plant managers was to make changes to what they already had at the smelter. On Oct. 23, 1970, Taylor announced plans to install Ducon Venturi pollution control equipment at the smelter in Columbia Falls beginning Nov. 1. The units, to be connected in line with the 30 existing wet scrubber towers, were expected to reduce fluoride emissions from the current 5,000 pounds per day to 2,500. Taylor credited research teams at the plant for developing the new pollution control system, which he said was designed for the Flathead Valley and would be capable of running at full efficiency 12 months of the year. [1] In early May 1971, Taylor announced that all 30 Ducon Venturi units had been installed at the plant at a cost of about $1 million, and that fluoride emissions had been reduced to about 2,000 pounds per day – less than the anticipated 2,500 pounds per day. [2]

AAC also looked into computerizing its pots so overheated pots were easier to locate. Overheated pots were thought to be a major source of pollution. [3] A typical problem for aluminum reduction pots was the anode effect – gas bubbles formed inside the pot between the anode and the molten bath and created electrical resistance, which caused the voltage of the pot to rise, which in turn caused the amount of heat in the pots to rise. Lodgepole pine poles were used by potmen to break the gas bubbles – metal poles would melt and introduce impurities into the molten aluminum, but pieces from wooden poles burned away and went up the stack with the pot gases. The number of pine poles used by AAC reflects the number of anode effects at the smelter. In 1968, with only six of 10 potrooms running, the AAC plant consumed 418,568 lodgepole pine poles averaging two inches in diameter and 12 to 15 feet long to extinguish anode effects. [4] In mid-May 1971, Taylor announced that a General Electric GE-PAC-30 process control computer system would be installed and put into operation on one of the plant's potlines by the end of 1971. The computer would precisely control the operation of the 120 cells in the potline resulting in higher metal production and less air pollution. The new computer system would cost more than half a million dollars, he said. [5] In August 1979, after eight years of use, AAC donated its General Electric computer to the Flathead Valley Community College. With a net book value of $386,000, the computer once controlled the aluminum plant's 600 reduction pots. By 1979, a new computer system was being installed as part of a $41 million air pollution control program which required more automation. [6]

Secondary emission control

According to AAC's petition to the state for an air pollution variance, the company's main plan to reduce fluoride emissions was to use Foamator wet scrubbers to control rooftop emissions. The Foamator wet scrubber was a new type of air pollution control equipment that had been considered for control of emissions from coal-fired generating plants in the United Kingdom in the late 1970s. [7] By 1977, Alfa Laval of Sweden had been developing foam scrubbers for several years. [8] In a feature article about the AAC plant in the October 1975 issue of the Western Aluminum News, a trade magazine for the aluminum industry in the Pacific Northwest, the company said the installation of a Foamator pollution control system along the rooftop of Potroom 8 was intended to be the basis of the company's 1975 to 1979 pollution abatement effort. The system was estimated to cost more than $14 million when completed plant wide. [9] This kind of money was within the Anaconda Company's reach. In 1974, the Anaconda Company, along with the Anaconda Aluminum Co., paid $15.4 million in taxes in Montana and employed 6,797 state residents. The company's capital expenditures ran to $125 million per year. [10] In the 1976 tax year, AAC was Flathead County's number one taxpayer. The company paid about $1.67 million in 1976, a 76% increase over the $966,000 it paid in 1975. [11]

Despite their financial health at the time, the Flathead County Commissioners announced plans in August 1975 to assist AAC with its fluoride problem. The commissioners scheduled a public hearing on a proposal to issue $2.5 million in industrial revenue bonds to help pay for new air pollution control equipment at the smelter. State law provided for counties to issue such bonds in the public interest. The bond amount accounted for only a portion of the total cost of the new equipment, but AAC would benefit by paying 8% interest on the money – about 2% less than for typical corporate bonds. [12] No protests were made at the Aug. 21 hearing, which saw formal endorsement for the bond proposal from the Montana Department of Health and Environmental Sciences (MDHES) and Glacier National Park. [13] The commissioners approved the bond measure on Sept. 10. The commissioners had left the matter open for public comment for 10 days, but no additional comment was received following the public hearing in August. [14] On Sept. 25, the public learned that AAC would use the $2.5 million to pay for installing a Foamator system on top of Potroom 8 as part of the company's commitment to reduce fluoride emissions. [15] News about the county's assistance was soon followed by news that AAC had received a hefty tax reduction. On Nov. 20, 1975, the Hungry Horse News reported AAC's tax valuations had been successfully appealed to the Flathead County Tax Appeal Board on the basis that the plant was more than 20 years old, and the reduction had been upheld by the Montana Tax Appeal Board. [16]

On Nov. 21, 1975, plant personnel met with the Montana Board of Health in Helena to discuss air pollution control measures at the smelter in Columbia Falls. The AAC plant was one year into its five-year agreement with the state to reach fluoride emissions compliance, and quarterly reviews were required by the state. [17] In March 1976, with plans to return the aluminum plant to full production from 60% capacity, AAC applied to MDHES for renewal of its air pollution variance – with a twist. The application also called for permission to alter and revise equipment intended to be installed for future pollution control. [18] By mid-1976, the rest of the story was revealed as the Montana Board of Health and MDHES granted an air pollution variance that allowed AAC to abandon its research and development of a foam scrubber system and to begin converting the plant's 600 reduction pots to a new Japanese technology and to replace the original wet scrubbers with a new dry scrubber technology for pot gases. [19] But there was other important news in the air by 1976 – stories about hostile takeover attempts on the Anaconda Company, and the company's air pollution problems at its copper smelter in Anaconda and copper refinery in Great Falls. On Jan. 13, 1977, the merger of the Atlantic Richfield Co. (ARCO) with the Anaconda Company was publicly announced. Reaction at the AAC plant in Columbia Falls was enthusiastic as it was expected that ARCO, a large oil company with deep pockets, would have the money needed to fund the air pollution control program underway at the AAC plant. [20] By one high estimate, the modernization efforts ended up costing ARCO $75 million to $100 million. [21]

The Japanese fix

When the Anaconda Company chose to enter the aluminum business in the early 1950s, it sent personnel to Europe to find an aluminum reduction system to use at its new smelter near the Hungry Horse Dam. The design choice was the Soderberg reduction pot, which was patented in 1918 by Carl Wilhelm Soderberg. By 1923, prebaked anodes had been in use for about 40 years, but the Soderberg system addressed the problem of carbon consumption with a continuous self-baking and monolithic anode, and it began to be used around the world. About the same time, aluminum producers began using prebaked cathode blocks when rebuilding pot bottoms, the cathodes in a reduction cell. Ramming paste was used to seal joints and corners. A Japanese company, the Sumitomo Corp., was the first company to manufacture and commercialize fully graphitized cathode blocks for aluminum reduction cells under the SK-Block trade name. The blocks provided significant energy savings due to higher conductivity. By the late 1970s, Sumitomo blocks and ramming paste could also be used to convert Soderberg pots to a more energy-efficient design that could also reduce air pollution. This was a breakthrough in the industry. The Sumitomo "dry" anode paste had a lower coal tar pitch content, and the new pot design introduced pneumatic-powered breaker bars to open up the crust that formed between the anode and cathode, which could automatically extinguish anode effects, along with point feeders for adding alumina to the reduction pots. The improvements lowered emissions of polycyclic aromatic hydrocarbons and made pot feeding easier, but companies that tried to implement the Sumitomo improvements in the early years ran into operational difficulties. [22]

The Sumitomo group of companies traced their heritage to the House of Sumitomo, a major merchant house of the Tokugawa period in the 17th century. At the end of World War II, giant family-owned business combines in Japan known as zaibatsus were broken up. In the 1950s, the independent Sumitomo companies began to re-associate, including a bank, a chemical company, a copper-producing company, a copper and aluminum fabricating company, a steel-producing company and a heavy equipment manufacturing company. Sumitomo Light Metal Industries Ltd. was set up as an independent company in 1959 primarily as an aluminum rolling operation, but over time it developed an aluminum smelting operation with interests in bauxite mines. [23] In 1975, according to company literature, the Sumitomo Chemical Co. built an aluminum smelter at Kikumoto in 1934. The company built a 54,000 ton-per-year smelter at Nagoya in 1961, an 81,000 ton-per-year smelter at Isoura in 1966, a 181,000 ton-per-year smelter at Toyama in 1970, and a 100,000 ton-per-year smelter at Toyo in 1975. The company had operated a 3,800 ton-per-year high-purity smelter in Kikumoto since 1941. The company also helped build the 112,000 ton-per-year aluminum smelter in Bluff, New Zealand. [24]

On Aug. 4, 1975, Chemical and Engineering News reported that the Sumitomo Chemical Co. was seeking to license its new technology for modifying Soderberg aluminum production cells. The company had already converted three of its smelters in Japan and had lined up its first customer overseas – a 110,000 ton-per-year smelter owned by Norsk Hydro. Sumitomo claimed the new cell design reduced power consumption by 15% to 20%, increased cell life by 50% to 100%, made a sizeable reduction in fluoride and hydrocarbon emissions, and reduced man-hours by 50% per ton of aluminum produced. The company said it had converted a total of 314,000 tons per year of Soderberg cell capacity in Japan. At the time, about half the aluminum potlines in the world used Soderberg pots. [25] In summer 1976, the Anaconda Aluminum Co. signed a formal contract with the Sumitomo Chemical Co. Ltd. to purchase the rights to use the company's aluminum reduction process technology, with plans to spend $35 million from 1976 through 1980 converting its 600 reduction pots at the Columbia Falls smelter to the new system. During the summer and fall of 1976, AAC supervisors and engineers visited Japan to see the new technology in operation. [26]

On July 29, 1976, AAC representatives made a regularly scheduled visit to MDHES in Helena to discuss progress in the plant's air pollution control work. Accompanying Taylor, AAC production manager Lee Smith and AAC technical manager Charles Fisher was a representative from Sumitomo Industries of Japan. The group informed MDHES staff that AAC proposed to use the Japanese aluminum smelting process in its effort to control emissions rather than installing the Swedish foam scrubber system. Earlier in the summer, Benjamin Wake, administrator of the MDHES Environmental Sciences Division, told the press that the AAC plant had made progress in fluoride emission controls. [27] On Aug. 9 and 10, two engineers from Sumitomo visited the plant in Columbia Falls after meeting with MDHES in Helena on Aug. 6, where the Montana Board of Health approved AAC's use of Sumitomo technology to control air pollution. [28] On Sept. 27, six Japanese engineers and two interpreters from Sumitomo began a two-week visit at the AAC smelter. In addition to modifying the anodes and cathodes of all 600 reduction pots at the plant, changes also would have to take place at the paste plant. The modification project would begin Jan. 1, 1977 and continue into 1979. [29]

In late October 1976, AAC formally announced that it had signed a contract with Sumitomo and would spend $35 million to reduce particulate emissions and save electrical power. The new system would take three years to install, and other changes would include a new dry scrubber system to control pot gas emissions. Completion was slated for July 1979 to comply with a completion date set by MDHES. Some modification work had already begun in the paste plant. AAC spokesmen said no additional workers would be needed to modify the pots since they could be changed as they were rebuilt on a regular replacement schedule. Extensive iron and brick work was expected for the pot modifications. Some additional workers might be required to help in building the dry scrubber units, AAC spokesmen said. [30] By early December, AAC representatives and technicians began returning from a trip to Japan where they visited an aluminum smelter run by the Sumitomo. [31]

The Alcoa solution

The dry scrubber system that AAC used to replace its wet scrubbers came from Alcoa, a leader in aluminum technology since it began as the Pittsburgh Reduction Co. in 1888. By the time it changed its name to Aluminum Company of America in 1907, the company owned bauxite mines, alumina refineries, hydroelectric facilities, aluminum smelters, aluminum fabricating plants and the Alcoa Technical Center in Pittsburgh for laboratory research and development. [32] In 1919, Francis Frary, a research chemist, became head of Alcoa's research and development. Together with William Hoopes, the company's chief electrical engineer, Alcoa developed a new way to make aluminum up to 99.99% pure. The success of the experiment helped propel Alcoa toward more laboratory research, sometimes to meet specific business needs. By 1913, Alcoa's laboratory in New Kensington, Pa., had 20 employees under the direction of Earl Blough, the company's chief chemist and metallurgist, and Hoopes. [33] By 1922, Alcoa owned 45 out of a total of 53 design patents held by a close group for the manufacturing of aluminum alloy engine pistons. [34]

The company's research budget had reached $700,000 by 1928, and Alcoa Chairman Arthur Vining Davis ordered a new facility built at New Kensington – the Aluminum Research Laboratory. Research also continued at other Alcoa plants – forgings at Cleveland, Ohio; electrical transmission at Massena, N.Y.; and alumina refining at East St. Louis, Ill. By the end of the 1930s, Alcoa could claim credit for developing 23 of 27 basic alloys and 17 of 20 wrought alloys in use by industry. In 1940, Frary had 220 scientists with advanced technical degrees working under him. Frary allocated up to 25% of his total research budget to fundamental research by scientists who were prominent in their fields. The company boasted 16 chemical labs, 11 physical testing labs and one motor lab, altogether employing 554 people with a $1.75 million annual operating budget. [35] By Sept. 30, 1949, Alcoa owned 775 patents, was the exclusive licensee of 57 additional patents, and was a non-exclusive licensee of more than 125 additional patents. Eleven of Alcoa's patents were considered competitively significant, including three key patents used in alumina refineries, and others for the production of aluminum fluoride, the direct-chill casting process and the manufacturing of important alloys. [36] Finding a better way to control fluoride emissions was also a goal.

By 1957, Alcoa researchers in New Kensington and East St. Louis had discovered that small quantities of hydrogen fluoride gas would react with alumina at low temperatures.

Using small-scale experiments, the researchers learned that hydrogen fluoride could be removed from pot gases by reacting the pot gases with alumina, and the captured fluoride could be returned to the potline reduction system in the reacted alumina. Early plant-scale systems ran into problems, but the project was revived in 1962 using reactors that were designed on a stand-alone basis. This system evolved into the Method 398 dry scrubber system. The reactor vessel included a support structure, a gas distribution plate, a plenum below the distribution plate for pre-distribution of the pot gases, and an upper section that included both a disengaging section for gravimetric separation of alumina from the pot gases and a baghouse for the final separation of solids from the exhaust gas stream. [37]

Alcoa's first recorded use of a dry scrubber to treat pot gas fumes from aluminum reduction cells took place on Feb. 23, 1965. The process was developed over time through a collaborative effort between Alcoa and Alcan-ASV. The first commercial injection-type dry scrubber system was installed at the Alcan-ASV smelter in Sundsvall, Sweden, in 1972 using separate reactors followed by cyclones and bag filters. In all cases, alumina was combined with pot gas so hydrogen fluoride gas or fluoride compounds could react and be eliminated from stack emissions. The reacted alumina containing the fluoride compounds was collected and stored and then fed to the reduction cells, thereby recycling fluoride and saving money as well as reducing fluoride emissions. [38]

Alcoa began to install the first Method 398 dry scrubbers in its plants in 1967. By 1971, the company had installed 123 Method 398 reactors at eight different locations, including three Soderberg plants. Another 59 reactor installations were planned. The system was being put on both older potlines and new potlines. The cost of the installation was estimated at $2 million for a 50,000 ton-per-year prebake potline, including reactors, exhaust fans and alumina handling equipment but not including pot hoods and fume ducts in the potline buildings. Costs for Soderberg systems were somewhat less. The cost for a Method 398 system for a 50,000 ton-per-year vertical-stud Soderberg potline, the type of reduction pots used at the 170,000 ton-per-year AAC plant, could range from $400,000 to $6 million. The installation cost for the system could range from $28 to $37 per ton of aluminum produced for new plants and about 50% more to convert older plants. The estimates were lower than the costs for conventional wet scrubbers or electric precipitator systems. Operating and maintenance costs were partially offset by the recovery of fluoride that otherwise would have been lost to the atmosphere. Operating costs could range from $2.90 to $4.70 per ton of aluminum produced, in contrast to $3.93 for wet scrubbers or electric precipitators. [39] Alcoa applied for a U.S. patent for the Method 398 system on March 7, 1968. The U.S.

Patent Office granted Patent No. 3,503,184 to Alcoa for its dry scrubber system on March 31, 1970. [40]

Routine maintenance was required for the Method 398 bag filter units, whether air pulse or shaker type, and bag replacement was perhaps the largest maintenance cost for the system. Dacron or Orlon bags could not handle pot gases exceeding 275 degrees Fahrenheit, while Nomex could handle up to 450 degrees at about twice the cost. The recommended solution was to cool the pot gas by diluting it with ambient air or spraying the exterior of the pot gas ducting with cooling water. Soderberg pot gases were much cooler than prebake pot gases, and Soderberg plants also emitted less pot gas than prebake plants, but care had to be taken to ensure that burners on the reduction pots were kept lit to prevent hydrocarbons from getting into the dry scrubber reactors. The modified sandy alumina produced by the Method 398 dry-scrubber reactors was found to have removed hydrogen fluoride with 99% efficiency. [41]

The grade of alumina produced in refineries around the world depended on the precipitation and calcining conditions. Two common types were floury or sandy. Sandy alumina had a larger surface area and was more suitable for use in dry scrubbing systems. [42] Tests also revealed that the purity of the metal produced by pots connected to the Method 398 dry scrubber system was as good – and in some cases, curiously better – than metal produced by pots not connected to the dry scrubber system. The Method 398 system also provided sufficient tolerance to handle changing loads, for example when reduction pots were taken off line. Alcoa installed multiple reactors at each location to provide some reserve capacity to tolerate overloading or an interruption of alumina supply. [43]

No big secret

Alcoa researchers had been studying ways to control fluoride pollution since the 1930s. The general philosophy at Alcoa was to combine environmental protection with business savings, so recycling pollutants made sense. The Method 398 system recovered about 99% of the fluorides that might normally escape the smelter. In 1979, it was estimated that Method 398 systems saved 80 million gallons of water normally used in wet scrubber systems, as well as reducing fluoride consumption by half. The system also reduced the threat of water pollution by switching to a dry system. Alcoa swapped 75 wet scrubbers for dry scrubbers between 1967 and 1990 and saved 5 million gallons of water per day. In 1971, shortly after passage of the 1970 Clean Air Act, Alcoa's capital investment in environmental protection was only 5%. That increased to 14% by 1979. During the 1970s, Alcoa spent $288 million on environmental protection measures alone. In 1975, Alcoa researchers developed the Method 446 system to treat hydrocarbon emissions from prebake furnaces. In 1981, Alcoa spent about $63 million on capital projects relating to environmental protection, or about 9% of total capital investment, and another $49.5 million on operating expenses for environmental protection. But by using the Method 398 system and similar systems, the company recovered $43 million in raw materials in 1981. For smelting operations alone, Alcoa recovered $35 million in 1981 through its environmental protection systems. This was not enough to recover all the capital and operating costs, but a sizeable sum nonetheless. [44]

By 1977, according to a U.S. government report, 18 of the 32 aluminum reduction plants operating in the U.S. used some type of dry scrubber system for the primary control of fluoride emissions, including the Method 398 fluidized-bed dry scrubber, the Air Industries injected-alumina dry scrubber, the Pratt Daniel-Alcan injected-alumina dry scrubber and the Kaiser-designed dry scrubber. Other types of primary control technology used at aluminum plants included wet scrubbers, multiple cyclones, venturi scrubbers, electrostatic precipitators and spray towers. Only five of the 32 U.S. aluminum smelters had secondary pollution control devices in place to capture emissions from potrooms, which included wet scrubbers or spray screens. [45]

Alcoa's dry scrubber technology was not a secret – information about the system was published in trade journals, national media and even the local Columbia Falls newspaper six years before AAC informed the Montana Board of Health of its decision to use Alcoa's system. A small article titled "Alcoa Offers Air Pollution Device to Aluminum Industry" appeared in the March 1970 issue of the journal Mining Engineering. A copy of the article reached the Hungry Horse News office in April 1970 and was published in full on April 3, 1970. The article said that Alcoa had developed a system that could remove nearly 100% of all fumes and particles emitted from electrolytic cells used to smelt aluminum. The device was being made available to other aluminum companies under a licensing arrangement. When asked about the system, a spokesman for the AAC plant in Columbia Falls replied, "The Alcoa device is applicable to prebake plants and wouldn't work here." [46] On April 10, the Hungry Horse News published a letter by Bob Muth who claimed local environmentalists had been aware for some time of the Alcoa pollution control system. He claimed that excuses for not using the system in the past at the AAC plant hinged on Alcoa's refusal to grant licenses to use the system, but now that the licenses were available AAC claimed the system would not work. Muth suggested that AAC convert its smelter from Soderberg pots to prebake pots so it could utilize the Alcoa system. "This would take money, big money, and Anaconda finds it more 'economical' to continue poisoning the environment," Muth said. "Anaconda will continue to poison the Flathead as long as valley residents allow it." [47]

On April 22, 1970, the Wall Street Journal ran a full-page advertisement by Alcoa that declared in large typeface, "We've put the lid on one kind of air pollution." The ad said that Alcoa's Environmental Controls Division had developed a new air pollution control system that could remove nearly 100% of pollutants. "If you make aluminum, we'll be happy to license the system to you," the ad said. "To help lower your costs and brighten your skies." Clancy Gordon, the University of Montana botany professor who had been investigating fluoride pollution by the smelter in Columbia Falls, wrote to Alcoa right away asking for more information on the system. [48] As Alcoa made its Method 398 emission control system available to competitors in the aluminum industry, the system was quickly adopted industry-wide to control fluoride emissions. [49] In August 1971, the Journal of the Air Pollution Control Association included an article titled "Operating experience with the Alcoa 398 process for fluoride recovery" that included the development history of the system, along with capital and operating costs. [50] In 1972, Alcoa formed a Technology Marketing Division to license proprietary processes and to sell engineering and construction services – including support for the Method 398 dry scrubber system. [51]

In 1975, one year before AAC announced its intent to implement the Sumitomo conversion and install Method 398 dry scrubbers, Larry Mitchell, an attorney with Cotkin, Colling, Kolts and Francell in Los Angeles who dealt with aluminum smelter lawsuits, wrote a letter in response to criticism of AAC for its air pollution problems. The letter was found in the Clancy Gordon archives at the University of Montana library. In the three-page letter, Mitchell explained that the Anaconda Company had considered using prebake reduction pots instead of Soderberg pots at the AAC plant prior to its initial construction but "at the time, 1955, plants utilizing the prebake system were experiencing worse problems of pollution control than were those using the Soderberg method." The problems with prebake pots later were addressed, and AAC opted to use prebake pots at its new Sebree plant in Henderson, Ky. "We have spent $13 million at Columbia Falls trying to solve our air pollution problem," Mitchell wrote. At the time, AAC in Columbia Falls had partially hooded reduction pots, pot gas collection systems, multiclone separators and a "highly efficient scrubber system that removes 98-plus percent of the fluoride it collects," Mitchell said. [52]

In the past two years, fluoride emissions from the smelter in Columbia Falls had been reduced by 300%, Mitchell said, and emissions easily met the state's ambient air standard of 1 ppb at each of the 37 sampling stations. But the plant continued to have difficulty meeting the state's fluoride emission limit of 864 pounds per day. Converting the entire plant to a prebake system "is clearly beyond rationale," Mitchell said, adding that it could cost $80 million and only reduce fluoride emissions by a small amount. The Anaconda Company had a $150 million investment in the Columbia Falls smelter, Mitchell said. In addition to the costs of converting to the prebake system, it would cost AAC about $5.8 million more to install the Method 398 dry scrubber system. Putting in rooftop scrubbers could cost at least $13 million on top of that. All decisions about the AAC plant in Columbia Falls were made at the Louisville, Ky., offices, Mitchell pointed out, where company officials looked at costs and benefits of any program. “Each individual component must first of all stand on its own and contribute a fair return on its investment,” he said. “We cannot expect any individual operation to exist at the expense of the others. Parasites are not allowed within the corporate structure.” With all that said, there was no guarantee that the plant could ever meet the state’s fluoride emission standard, Mitchell concluded. [53]

A giant remodeling project

AAC received an air pollution operating permit from the state of Montana on July 16, 1976, for the installation of a dry scrubbing system and modifying the smelter’s Soderberg pots to the Sumitomo process control technology. [54] In late December, word came from Sen. John Melcher that AAC had signed a contract with Alcoa agreeing to spend $7.2 million for new dry scrubber air pollution control technology. The expense was considered part of the overall $35 million slated for pollution control and modifications of the reduction pots the Sumitomo process. [55] From 1976 to 1980, the big conversion included structural engineering changes to 600 reduction pots, operational and process changes, and new raw materials. In addition to reduced particulate and fluoride emissions, benefits included reduced power consumption, longer lifespans for reduction cells and fewer man-hours required for operating and maintaining the facility. During that same time period, AAC converted the plant’s primary air pollution control equipment from multiclones and wet scrubbers to ten Method 398 dry scrubber reactors – one reactor per potroom, including four in the West Plant dry scrubber facility and six in the East Plant facility. That worked out to 60 reduction pots per reactor. [56]

The Anaconda Aluminum Co. was the first aluminum company in the U.S. to incorporate smelting technology from the Sumitomo Corporation of Japan. [57] A formal contract was signed in summer 1976, and AAC supervisors and engineers visited Japan to look at the process in the summer and fall. [58] In April 1977, a new security system was implemented at the plant in Columbia Falls requiring photo-identification passes. The reason given for the additional security was to safeguard the new Sumitomo process technology being used on the reduction pots at the plant. [59] On June 14, Charles Fisher, the smelter’s technical manager, spoke to the Columbia Falls Chamber of Commerce about the air pollution control program. The plant was converting five pots a week to the new Sumitomo process technology, he said. The new pot design would not only reduce pollution but also lower electrical power consumption by 6% or more. Two new dry scrubber reactors would be in operation by January, and modifications were underway at the carbon paste plant so it could produce the new dry-type anode paste required by the Sumitomo process. [60] On July 22, the Montana Board of Health and MDHES personnel were updated on what by then was described as a $41 million air pollution control program. The board agreed to continue the company's variance for another year. Taylor and Fisher reported that one of the 10 potrooms had been completely converted over to the Sumitomo process, and a significant reduction in fluoride and particulate emissions already was evident. Jon Bolstad, an engineer with the state's Air Quality Bureau, recommended that the variance be granted because he was satisfied with progress in the plant's implementation of the new Alcoa and Sumitomo systems. The objective was for the plant to attain the state standard of 864 pounds of fluoride emissions per day by the middle of 1979. [61]

To convert a reduction pot from its original Pechiney-influenced design to the Sumitomo technology, the pot first had to be removed from its position in the potline. For each day that "hole" remained unfilled, aluminum production at the AAC plant fell by about 1,600 pounds. Even if a new Sumitomo pot was ready to be put in right away, it could take several weeks to get it running properly. During start-up, the heavy steel, brick and carbon lined pot bottom was heated by natural gas and electric power to 1,740 degrees so cryolite bath could melt and dissolve alumina for reduction into aluminum metal. Secondary emissions in the potrooms could significantly increase during the start-up process, and at five pot change-outs per week during the two years of the Sumitomo conversion, emissions were higher for the plant as a whole. [62]

Before removing a reduction pot, the tapping crew sucked out as much molten aluminum and bath as possible from the 18-foot long, 8-foot wide pot bottom. Two 50-ton overhead cranes were used to lift the hot 60-ton anode and haul it away for reconfiguring, which included installing new Sumitomo crust-breakers and the pneumatic cylinders that drove the steel arms. Other modifications included steel work. The same overhead cranes also lifted out the 100-ton cathode bottom for reconfiguring. The hot pot bottom was hauled to the North Crane Bay area and tipped upside down, dumping brickwork and carbon that was contaminated with cyanide created over years of operation when nitrogen from the atmosphere entered the cell and combined with the carbon lining. During the two years of the Sumitomo conversion, spent potliner from more than 600 pot bottoms ended up in landfills on the plant site. The pot bottom was then hauled to a shop where modifications were made to accommodate Sumitomo pre-baked cathode blocks and other design changes. That included new steel and brick work. [63]

The first of two new dry scrubber systems went online on Jan. 9, 1978. [64] The company was dedicated to getting the plant converted to the new equipment and was making progress until April 1978 when serious problems arose while putting the new Sumitomo technology to work in the old reduction pots. Problems in the rebuilt pots reached a peak by June just when the Montana Board of Health and MDHES sent a delegation to tour the facility. Premature failures of cathodes in reduction pots and serious anode spiking resulted in a decision by the company to stop all pot conversions until a solution to the problems could be identified. By September 1978, when the company applied for another air pollution variance from the Board of Health, many of the problems had been identified and solutions had been developed. The conversion program started up again and high air pollution levels, which had been readily evident inside the potrooms, returned to normal. By Aug. 31, according to Robert Sneddon, the manager of the AAC's operations at Columbia Falls and Sebree, about 319 of the plant's 600 reduction pots had been converted to the Sumitomo design, the dry scrubber system for the West Plant was in operation, all of the plant's pots used anode paste produced according to Sumitomo specifications, all of the anodes and cathodes in Potroom 9 had been changed over to Sumitomo operation practices, but installation of a new process control computer system was necessary before full emission control benefits could be realized. [65]

AAC installed IBM 1800 Series 1 process control computers to control the voltage of the plant's 600 reduction pots in 1978. Software logic was changed by April 1979 to accommodate the new Sumitomo technology. After that, more plant-specific software was added which provided information exchange between potroom technicians and the computer, and which added more automatic features. Every 30 seconds, the voltage across the anode and the cathode of each pot was measured by the computer and recorded, a process which took only five seconds for all 600 pots. Every 30 minutes, the computer made a decision to adjust the voltage of any pot by activating motors that drove the anode up or down as needed. The voltage of a reduction pot correlated with the heat inside the pot, and potroom technicians determined what voltage was best for each individual pot. The computer also ordered the new Sumitomo automatic crust-breakers to feed ore to the pots on a regular schedule. Five computers were installed, one for each potline. Prior to the installation of the computer system, voltage adjustment and ore-charging functions were determined manually. In the future, the company hoped to use the computer system to improve energy efficiency and pot stability along with more thorough diagnoses. [66] AAC readily adopted computer technology plant-wide. By the end of April 1979, twenty-five employees at the smelter had completed a computer course at the Flathead Community College. The employees included mostly engineers but also accountants, analysts, laboratory technicians, clerks, and power and utility supervisors. The course covered IBM's 370 computer system, which was installed at the plant in November 1978 for accounting, payroll, warehousing and purchasing. The director of the company's computer center hoped to install 29 terminals around the plant by the end of 1979. [67]

The federal lawsuit

The Montana Board of Health and MDHES granted AAC an air pollution variance during a hearing in Helena on Sept. 8, 1978, which allowed the plant to continue emitting fluoride above the state standard until June 30, 1979. About 400 of the plant's employees were involved in the big conversion by that time, which was about 50% complete. [68] Clinton Carlson, a plant pathologist for the Forest Service in Missoula, testified at the hearing and sharply criticized AAC's air pollution control program. Carlson said Forest Service personnel had suspected fluoride-caused damage to ponderosa pines near the AAC plant occurred as early as 1957 – two years after the smelter first went into operation. After the plant expanded operations from two potlines to five in 1965 through 1968, damage to commercially valuable species spread to large acreages on federal, state and private lands. Between 1970 and 1978, Carlson testified, "there has been little or no improvement in controlling fluoride emissions from the aluminum plant." In addition to aesthetic losses incurred by the fluoride emissions, nearly 11 million board-feet of timber had been lost since 1968 as a result of the plant's fluoride emissions, Carlson said. In the eight years since Montana adopted a fluoride emission level for the plant at 864 pounds per day, the plant had continued to emit three to five times that amount. "Numerous variances from the standard have been granted to AAC in the past, but to date there has been little or no reduction in pollution damage," he said. Citing various federal laws mandating that the Forest Service "protect and manage forest resources for the good of the American people," Carlson argued that the variance request by AAC should be denied. [69]

The general expectation on Sept. 8, 1978, was a routine third-time granting of the variance by the Montana Board of Health and MDHES. The variance was granted, but only after heated testimony by Carlson and Bolstad. According to the Hungry Horse News, "Carlson's appearing before the Board of Health Friday in Helena fits in with the Carter administration taking a strong stand regarding air pollution and its harmful effects on the national parks." Carlson called for imposing a stiff fine that would give AAC more incentive to speed up its pollution control efforts. Without a variance, the company was subject to a $1,000 per day fine for exceeding the state fluoride emission standard. AAC management pointed out that it was ahead of schedule in its $38 million program, although it was having trouble training qualified personnel to oversee the project. [70]

Bolstad testified that AAC had been making progress in its air pollution control program until serious problems arose in April 1978. These problems, he noted, were being straightened out and the state expected that AAC would be ready to demonstrate the effectiveness of its new program by Jan. 1, 1979. Noting that the Montana Board of Health had recommended granting the variance to AAC, Bolstad added, "We expect this to be the last variance that Anaconda Aluminum will need." [71] According to a report on impacts to forests by fluoride pollution that Carlson completed for the Forest Service in 1978, the smelter had emitted more than 14,000 pounds of fluoride per day when the fourth and fifth potlines were completed in 1968. That is the highest estimate made by any scientist studying the case. Wet-scrubber equipment was improved that brought down fluoride emissions to 4,400 pounds per day. About 90% of the emissions were in gaseous form as hydrogen fluoride, and about 10% were in particulate form as cryolite or chiolite, compounds of sodium, aluminum and fluoride, and as aluminum fluoride. [72]

The federal government had been collecting information about fluoride damages on National Forest land and Glacier National Park for nearly two decades when it finally decided to take action in court. Flathead National Forest Superintendent Ed Corpe had sent an outline of damages alleged to be caused by pollution from the AAC plant to the Justice Department for review in September 1974 but had not received a reply by September 1975. On Sept. 29, 1975, the Flathead County Commissioners wrote to Corpe urging the Forest Service to delay legal action against AAC. The commissioners pointed out that AAC paid more than one-third of the county's taxes and that the plant had recently acquired $2.5 million for pollution control through industrial bonds issued by the county. The commissioners urged that legal action be delayed until the plant had a chance to implement their pollution control program in full. [73] The commissioners' request, however, did not stop the U.S. Attorney General from filing a lawsuit against the Anaconda Aluminum Co. on Nov. 6, 1978, to stop the Columbia Falls smelter from emitting fluorides at a harmful level. [74]

For the National Park Service, work toward an agreement on litigation strategy and goals began a year earlier. On Sept. 6, 1977, James D. Webb, the associate solicitor for the National Park Service's Conservation and Wildlife Division, wrote to James W. Moorman, the Acting Assistant Attorney General, about fluoride emissions from the AAC plant impacting Glacier Park. "The impact of the fluoride emissions in Glacier National Park has not been as dramatic as that in the Flathead National Forest, which is closer to the reduction plant," Webb said. "National Park Service records and conversations with the current superintendent reveal no cases of either flora or fauna dying from what could conclusively be identified as fluoride poisoning. Thus, in a lawsuit framed as an action to recover damages for dead or dying biota, the departmental interest at this time is the precedential value which successful prosecution of this action would have. In that respect, we support this litigation and are willing to offer any help we can." [75]

On Nov. 4, 1977, David A. Watts, the assistant solicitor for the National Park Service's Parks and Recreation Division, wrote to National Park Service Director William Joseph Whalen about the AAC fluoride emissions. Watts referred to communication between Glacier Park Superintendent Phillip Iversen and Neil Guse Jr., at the National Park Service's Natural Resources Management Division, on Oct. 5, 1977. "It is concluded that fluorides emitted from the Anaconda aluminum plant at Columbia Falls, Montana, currently are being transported by prevailing winds to Glacier National Park, are accumulated by various plant species in the Park, and are causing light injury to sensitive plants, similar to the situation in 1971-74," Guse had said in an earlier memo. Citing this new information, Watts recommended that the Park Service join the Forest Service in their action to abate fluoride emissions and to recover damages for past injury. Watts noted that in the recent past, the Park Service was unable to document injury by fluoride and had declined an invitation to join the legal action by the Justice Department. Watts recommended that the declination be reconsidered. [76]

Putting a price on natural resource damage was easier for the Forest Service, which sold trees as timber, but it was a different matter for the National Park Service, which was obligated to protect resources in their natural condition. This matter was discussed by Iversen in a Nov. 15, 1977, memo to National Park Service Director William Joseph Whalen. "We were surprised that the information submitted in our memorandum of October 5, 1977 prompted a recommendation from the Solicitor to join the U.S. Forest Service in litigation against Anaconda Aluminum Company," he said. Iversen cited a report by the Forest Service's Deputy Regional Forester S.H. Hanks which summarized Glacier Park fluoride studies and found injury by fluoride in six of seven sites, including scattered tip burn on two to three year old conifer needles. "The question is how do we change this situation," Iversen asked. "I do not think we should go to court or ask for remuneration – to imply that we can be paid off for environmental damage. I do think we want Anaconda Aluminum Company to cease and desist from causing pollution in the Park." Iversen described AAC's approval for a variance to Montana fluoride compliance and progress in converting the aluminum plant to new pollution control equipment. He also noted that fluoride impact studies in Glacier Park cost about $60 per tree. [77]

Developing a lawsuit

Litigation options were not straightforward and needed to be understood before the federal government was willing to commit to legal action against AAC. On May 9, 1977, Richard L. Fowler, director of the Forest Service's Natural Resources Division, wrote to

U.S. Attorney General Griffin B. Bell and suggested that if the facts warranted such action, that the U.S. Attorney take appropriate legal action against AAC for impacts to the Flathead Forest. "The actions of Anaconda are effectively depriving the United States of any use of its land," Fowler said. "For this total deprivation of the use of its land, it is our belief that the United States should recover for the total value of the lands which have effectively been taken by Anaconda for its use." The difficulty so far had been in determining the amount of damage. Assuming about 20,000 acres of Forest Service land were adversely affected by elevated levels of fluoride, a preliminary estimate of damages by the Forest Service ranged from $2 million to $80 million, along with $105,000 to pay for estimating damages and potential punitive damages. [78]

Fowler noted that two plots were established on the east side of Teakettle Mountain in July 1956 to evaluate changes after the aluminum smelter initially began operating, but the plots were not continuously maintained and could not be relocated in 1970. In June 1957, Forest Service personnel noticed dead ponderosa pines in the Teakettle Mountain area. Don Leaphart of the Inland Empire Research Center looked at the dead trees and said he believed the cause was fumes from the AAC plant, but chemical analyses were needed and weren't done. No more evaluation of fluoride impacts was conducted until 1969, after the smelter had expanded to five potlines. In November 1969, the Wisconsin Alumni Research Foundation (WARF) conducted vegetative tissue analysis in the Columbia Falls area, which was followed up by the Forest Service in 1970. The results of both studies indicated fluoride was the primary cause of the injury to vegetation in the area, Fowler said. Visible fluoride damage could be seen on more than 69,000 acres of mixed ownership, and elevated levels of fluoride were found on more than 214,000 acres of mixed ownership. In 1971, the Forest Service monitored vegetation on 20% of the plots from the 1970 study, and a considerable reduction in fluoride injury was reported. Visible injury was found on 15,200 acres, including 4,450 Flathead Forest acres, and elevated levels of fluoride were found on 179,000 acres, including 38,130 Flathead Forest acres. In August 1972, fifteen plots from the 1971 study were sampled and conditions were found to be unchanged, consistent with the reduction in AAC fluoride emissions from 7,600 pounds per day in 1969 to 2,500 pounds per day in 1971 and no further reduction since then. [79]

Fowler also described two studies of insects and growth of lodgepole pines in anticipation of a legal defense by AAC that claimed insects were causing the death of trees, not fluoride. A significant relationship had been found between fluoride impacts and insect impacts, Fowler said, but "this means that fluoride injury weakened the vegetation in the area and made it susceptible to insect attack." By January 1972, thirty local lawsuits were pending against AAC, Fowler said, with Kalispell attorney Dale McGarvey handling most of them. Fowler said McGarvey was willing to share information with the Forest Service, and Clinton Carlson had been deposed by McGarvey in the Dehlbom v. AAC case in Columbia Falls. Fowler said many of the local lawsuits had been settled, with damages ranging from $500 to $1,500 per acre for tracts of land less than 640 acres. Fowler also noted that the House Subcommittee on Public Lands had held hearings on the AAC fluoride emissions. AAC initially was required to comply with fluoride emission standards set by the state of Montana with the backing of the federal Clean Air Act of 864 pounds per day by June 30, 1973, and he wasn't sure how close the company was to compliance in 1977. Absent a violation of federal or state law, the government could turn to common law to file an action against AAC, Fowler said. "Under a nuisance theory, the United States would have to prove negligence," Fowler said. "While Anaconda would have no defense as to past damages, evidence of its compliance with a state standard may be sufficient to relieve it of liability under a nuisance theory." [80]

Fowler also reported on several fluoride pollution cases filed against aluminum plants in Oregon. In Fairview Farms v. Reynolds Metals Co. and Arvidson v. Reynolds Metals Co., which dealt with fluoride emissions from the aluminum plant in Troutdale, the plaintiffs had issued claims based on nuisance and trespass theory. The court, however, had held that trespass was the proper theory, and the plaintiffs were unable to prove consequential damages and failed to recover anything. In the Martin et.al v. Reynolds Metals Co. case, the court recognized the settling of fluoride on the land as a trespass but treated the case as a nuisance and the plaintiff had to prove negligence. In Renken v. Harvey Aluminum, which dealt with fluoride emissions from the aluminum plant at The Dalles, the constant settling of fluorides on the land was treated as both a continuing trespass and a nuisance. The court ordered improved pollution control equipment installed within a year or the court would issue an injunction. Harvey appealed and later settled through arbitration for $942,000 in damages. In Paul and Vera Martin v. Reynolds, which dealt with the Troutdale plant, the appellate court ruled that trespass and nuisance claims overlapped and punitive damages were justified if compensatory damages were not sufficient to deter Reynolds from committing similar trespasses in the future. [81]

Fowler also reported on Dutton v. Rocky Mountain Phosphate Corporation in 1968 and 1969, which involved fluoride emissions from a phosphate plant in Garrison, Mont. The court had awarded the plaintiffs compensatory and punitive damages and enjoined the defendant from emitting fluorides in excessive quantities or beyond safe levels. The court ruled that "one who maintains a condition, or engages in an activity, which involves a high degree of risk or harm to others and is abnormal in the community and inappropriate to its surroundings, is strictly liable for the harm which it causes." Fowler also cited Montana law from the Revised Codes of Montana 1947 which stated, “Anything which is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property, or unlawfully obstructs the free passage or use, in the customary manner, of any navigable lake, or river, bay, stream, canal or basin, or any public park, square, street or highway is a nuisance.” Fowler also cited several federal laws that AAC might be violating that involved wanton destruction of public lands or wanton injury or destruction of any tree growing, standing or being upon any land reserved by the United States. [82]

The federal lawsuit filed in U.S. District Court in Missoula on Nov. 3, 1978, on behalf of Agriculture Secretary Robert Bergland and Interior Secretary Cecil Andrus alleged that trees, plants and wildlife in the Flathead Forest and Glacier Park had been injured or killed by fluoride emissions from the AAC smelter in Columbia Falls. “Such trespass has irreparably injured the forest, natural resources and wildlife of the national park and national forest areas,” the four-page complaint stated. The complaint requested that the court order AAC to stop emitting fluoride at levels that caused these damages. In addition to seeking a permanent injunction, the U.S. Attorney General wanted: 1) damages for the decrease in the value of property, amount to be determined at trial; 2) triple damages for loss of timber in accordance to Montana state law Section 17-503 of the Revised Code of Montana 1947, amount to be determined at trial; 3) damages resulting from the necessity of eliminating fire hazards in the Forest and Park, amount to be determined at trial; and 4) such other relief as the court may deem just and proper. The complaint was signed by Assistant Attorney General James W. Moorman, U.S. District Attorney Robert O’Leary of Butte, and U.S. Department of Justice Land and Water Resources Division attorneys Steven Herman, David Waters and David Cannon Jr. [83]

The federal complaint specifically stated that: 1) the AAC plant had emitted and continued to emit phytotoxic gaseous and particulate fluoride air pollutants; 2) the fluoride pollutants were deposited on National Forest and National Park property; 3) large numbers of trees had died as a result of the fluoride emitted from the plant; 4) the absorption of fluoride emissions had injured vegetation by reducing photosynthesis and retarding diameter growth; 5) if the pollution continued, the fluoride concentration in trees and vegetation would increase, causing the death of more trees and vegetation and a reduction of growth in others; 6) many dead trees in the National Forest and National Park posed a forest fire hazards; 7) the aesthetic and recreational value of the Forest and Park had been significantly diminished by acres of trees and vegetation killed or injured by the fluoride; 8) the monetary value of the Forest and Park had been severely diminished; 9) wildlife in the Forest and Park had suffered injuries, including skeletal fractures, tooth disintegration and severe fluorosis, all of which would ultimately lead to death; 10) the AAC plant now emitted more than two tons of fluoride air pollutant per day, while the Montana state limit was 864 pounds per day; 11) even at the 864 pounds per day emissions level, vegetation in the Forest and Park would continue to be damaged; 12) unless fluoride emissions from the plant were limited to 200 pounds per day, the Forest and Park would continue to suffer death and irreparable injury to trees, vegetation and wildlife. [84] The complaint's demand that fluoride emissions be reduced to 200 pounds per day would pose a significant hurdle for AAC if granted.

Reaction to the lawsuit

Reaction in Montana media in support of the government or the company depended on where the reader lived. "The company's defense likely will hinge on the question of economic feasibility and jobs," Missoulian editor Sam Reynolds said in a Nov. 9 editorial. "Cutting pollution to 200 pounds a day would be expensive – possibly too expensive for the Columbia Falls plant to remain economically competitive." He noted that the issues will be balanced by a jury. "But win or lose, the suit is interesting," he said. "It marks a major turn in federal policy: polluters of public property might be sued. It builds a fire under this and other companies to work earnestly on pollution control. It puts the state on notice that it must impose and enforce standards that protect public property." [85] A Nov. 16, editorial in the Hungry Horse News noted that AAC officials regarded the state's fluoride emission standards as too rigid. The smelter was emitting more than 4,000 pounds of fluoride per day while the state standard allowed only 864 pounds and the plant was operating under a variance granted by the state. The federal lawsuit called for reducing the fluoride emissions to only 200 pounds per day in order to prevent further "death and irreparable injury to tree, vegetation and wildlife." The lawsuit implied that the state was not adequately enforcing air pollution regulations and the federal government was stepping in to get the job done, the editorial said, but more than 1,360 employees might lose their jobs if the plant shut down. [86]

On Nov. 18 to 19, 1978, representatives from ARCO and the Anaconda Aluminum Co. met in Denver to discuss the U.S. v. Atlantic Richfield and the Anaconda Company lawsuit. Jim Robischon of the law firm Poore, McKenzi, Roth, Robischon and Robinson of Butte was appointed chief counsel to answer the federal suit. [87] The government sought compensatory and punitive damages for the period Nov. 3, 1972 through Nov. 3, 1978 and for future damages until continuing damage was abated. Treble damages were requested for certain time periods. Anaconda Company attorneys questioned various government officials from 1978 through 1979 to gather evidence for the company's defense. According to the interrogatories, U.S. government officials noted that some studies were continuing, including studies to describe the exact mechanism that explained how fluoride damaged trees. The basic claims in the lawsuit included: 1) "The fluoride emissions from the defendant's plant have resulted in loss of use and enjoyment of various uses of the land prescribed by the Multiple Use Act of June 12, 1960." 2) "These uses include aesthetic, recreational, grazing, wildlife, water, scenery, natural and historic objects, and other intangible uses which have been significantly diminished by the presence of acres of trees and vegetation killed or injured by fluoride emissions from the defendant's plant." 3) "The intangible losses are in addition to the reduction in value of the (lands)." 4) Proof that fluoride had actually been found on the Flathead Forest was "a matter of public record." 5) Proof that fluoride had actually been found in Glacier Park included monitoring by AAC themselves, and that from this data, "it can be surmised that measurable accumulations have been and still are occurring in Glacier National Park." [88]

According to statements by U.S. officials in the interrogatories, the amount of fluoride found in Glacier Park tended to be highest in summer time and "have generally increased since 1975." And data showed that fluoride concentrations were still accumulating in pine trees and grasses in Glacier Park. Areas on the west side of the Continental Divide where sampling had been conducted for fluoride included the Blankenship area, Fish Creek Campground, the Glacier Park headquarters area, Bowman Lake, the head of Lake McDonald, the Camas Creek area, Huckleberry Mountain, Apgar Mountain, and the Middle Fork of the Flathead River at Lincoln Creek. Data on the impacts of fluoride on animals included sampling by AAC consultants from July 9, 1972 through Aug. 12, 1972 on six Columbian ground squirrels, six deer mice, six yellow pine chipmunks and three golden-mantled ground squirrels. When asked how to set a value on Flathead Forest timber, U.S. officials cited the Flathead Forest Plan and various acts of Congress. When asked if AAC "willfully" emitted phytotoxic gases and particulates, U.S. officials answered yes – AAC was aware of the reports but continued operating. When asked if AAC "wrongfully" emitted fluorides, the answer again was yes – AAC knew of the reports and there was evidence of damage. When asked if "hazardous" conditions were created, the answer again was yes – dead trees created a fire hazard. On further questioning, the Forest Service said, there had been only one fire in the affected area from 1954 through 1978 – a one-acre lightning-caused fire that was put out in two hours. Glacier Park said 50 fires had occurred from 1954 through 1978 in the isopol 10 area on the map created by Forest Service scientists to show fluoride concentrations in plant life. [89]

Deposition and dissertation

The lead investigator for the Forest Service was Clinton Carlson, a plant pathologist based in Missoula. According to his statements in a 1979-1980 deposition for the U.S. v.

ARCO air pollution case, Flathead Forest officials had requested help from Forest Service scientists in Missoula in 1969 "to make a field evaluation of a problem on Teakettle Mountain that they suspected to have fluoride damage but weren't really sure." Carlson returned to the area in 1970 with a designed field study. In December 1970, Carlson and others learned that AAC had installed a new air pollution scrubbing system and had reduced emissions from 7,500 pounds of fluoride per day to 2,500, and the Forest Service wanted to know if the new equipment had made a difference. Carlson returned in 1971 to look at 20% of the plots established in 1970, and then returned to the Flathead in 1972 and 1973. According to the deposition, Carlson found that "there was essentially no change in the status of damage to vegetation or any amount of fluoride that had been accumulated by plants." In 1973, a new problem emerged in the area – an infestation by five different insect species, which was considered an epidemic in the polluted area. "It seemed to me more than circumstantial that the entire epidemic was contained within the polluted area," Carlson said in the depositions. The occurrence was also something never before seen in the scientific literature, he said. Carlson conducted another study in 1974 to take into account the insect infestation and discovered a statistically significant relationship between fluoride and insects that he reported in 1974. He said a mountain pine beetle infestation was occurring at that time in the North Fork of the Flathead River valley and in parts of Glacier National Park. [90]

According to the depositions, Carlson also undertook a study in 1974 that looked at damage to needles and broad-leafed plants and reduced growth rates in lodgepole pines. He followed that up with a study of growth rates by other species of trees on Teakettle Mountain. He concluded that he could differentiate between injuries to needles caused by fluoride and injuries to needles caused by abiotic agents – such as weather or salt. He also used infrared aerial photos taken in 1977 on a scale of 1:4,000 on 9-by-9 inch film taken by a Fairchild KA1 camera. The photos were detailed enough to be used in a stereoscopic viewing device to count individual dead trees. The intensity of infrared light reflected off the trees was related to the amount of chlorophyll in the needles and was an indicator of growth, Carlson said. Among his findings was that levels of sulfur found in needles increased at the same amount as for fluoride. Sulfur dioxide was emitted from the AAC smelter when carbon paste briquettes melted in the Soderberg anodes. The briquettes were made from coal tar pitch, which contained sulfur. But Carlson didn't believe sulfur was a significant cause of the damage to trees. All of these findings were included in his 1978 Ph.D. dissertation at the University of Montana. In the depositions, Carlson said he told his dissertation review committee of his opinion about sulfur, and they were agreeable with that conclusion. He also said his dissertation did not explain how hydrogen fluoride impacted plants at the cellular level. [91]

Carlson's dissertation on fluoride impacts to forest lands near the AAC plant was approved by the University of Montana's Board of Examiners on June 2, 1978. University of Montana botany professor Clancy Gordon was Carlson's dissertation chairman. The 165-page dissertation document included data from field work and aerial infrared photography that underwent statistical analysis using a computer, and data from experimental fumigation of plants with fluoride in a laboratory setting. Carlson discussed impacts other than fluoride that could have impacted forest lands near the AAC smelter, including insects and drought. Needles from Douglas fir, lodgepole pine and white pine from 28 randomly selected forest stands were sampled and analyzed for fluoride content. Increment core sampling was done to trees in both the polluted area and control areas to determine radial growth rates for two 10-year periods, 1958 to 1967 and 1968 to 1977. Fluoride analyses were conducted on wildlife forage, and total sulfur was measured in a small number of samples. [92]

According to the dissertation, Carlson and Forest Service entomologist Jerald E. Dewey had analyzed data from their studies of forest lands impacted by fluoride emissions from the AAC plant in 1971 as "isopols," a term created to identify areas that received about the same dosages of fluoride over time and which could be depicted on a map as lines similar to a weather chart. For example, the average fluoride content on a dry-weight basis for a sample of one-, two- and three-year-old conifer foliage and current shrub, herb and grass leaves within the 100 isopol would be 100 ppm. Inside the 30 isopol area, the fluoride content would be 30 ppm. "Although this is a very general way to classify fluoride accumulation, it is a good basis from which to stratify the area," Carlson wrote in his dissertation. Carlson divided the impacted area into three strata – the area within the 100 isopol, with 35 tree stands and eight studied; the area between the 30 and 100 isopols, with 221 tree stands and 10 studied; and the area outside the 30 isopol, with 110 tree stands and 10 studied. A tree stand was defined as "a more or less homogeneous assemblage of one or more coniferous species," Carlson said. Personnel from the Glacier View Ranger District in Columbia Falls had already delineated the stands, and a standard inventory was conducted for each stand based on 1976 Forest Service procedures. [93]

Additional sampling included radial increment core drilling, foliage collection for laboratory analysis, and subjective field observations and photographs to show impacts by insects, biotic disease or fluoride injury. The core samples were measured to within 0.01 inches to determine growth rates for lodgepole pine for 1958 through 1967 and 1968 through 1977. The smelter had expanded from three potlines to five in 1967 through 1968, nearly doubling aluminum production and fluoride emissions. Carlson also utilized infrared aerial photography to delineate damage to forests by insects and fluoride. The entire polluted area was stereo-photographed at a scale of 1:4,000. In addition, three strips of land extending into the polluted area from the AAC plant were photographed at 1:1,200, using a Fairchild KA-2 camera with 24-by-24 film. The film was analyzed using a Delft scanning stereoscope. Healthy green foliage was known to have a high spectral reflectance in the near-infrared range. Infrared images were also known to enhance visible pollutant effects, such as leaf chlorosis and necrosis, and branch and tree mortality. Histological studies also were conducted in a laboratory setting using two-year-old Douglas fir and ponderosa pine seedlings. The seedlings were divided into groups and treated with excessive salt, drought, simulated winter injury, sulfur dioxide, hydrogen sulfide, ethyl mercaptan and hydrogen fluoride. One group was the control. Conifer needles for laboratory analysis were collected from around the AAC plant, from the Rhone Valley in Switzerland near three aluminum smelters, from land near a phosphorus plant in Ramsey, Mont., from land near the Anaconda Company's copper smelter in Anaconda, Mont., and from land near the Hoerner-Waldorf pulp plant near Missoula, Mont. [94]

Carlson's conclusions in the dissertation included: 1) that the percent of conifer needle tip necrosis and mottle increased within the polluted area, and the percent of healthy needles decreased as the percent of fluoride concentrations increased; 2) needle retention and needle length decreased with increasing fluoride concentrations; 3) radial growth rate of the conifers since 1968, when the AAC plant expansion was completed, had been dramatically reduced; 4) conifer mortality increased with proximity to the AAC plant; 5) air pollution, most likely fluoride, had caused a loss of public timber resource by reduced growth and mortality from 1968 to 1977 of about 10.75 million board-feet of usable timber on 13,245 acres, which he estimated to be worth $679,000; 6) fluorides were emitted by the AAC plant in Columbia Falls; 7) sulfur oxides emitted by the AAC plant accumulated in vegetation and might be adding to the damage caused by fluorides or increasing damage in a synergistic fashion, but fluoride was about 250 times more toxic to vegetation than sulfur dioxide; 8) wildlife forage was accumulating an abnormally high concentration of fluoride, which likely posed a health problem for wildlife; and 9) needle tip necrosis caused by natural abiotic factors, such as winter drought or summer drought, could be differentiated histologically from injury caused by phytotoxic pollutants, such as fluorides, sulfur oxides and reduced sulfur compounds. In conclusion No. 10, Carlson said, "There is no threshold for injury and damage. Any fluoride above baseline (4-5 ppm in foliage) can cause damage over time with continuous fluoride intrusion. Thus, any fluoride air quality standard established over baseline will not ensure protection of the public welfare – tradeoffs will be made. As an opinion, something less than 100 kg (220 pounds) per day total fluoride emissions from the Anaconda Aluminum Co. may be a reasonable compromise between no emissions and the current 2,000 plus kg/day emitted daily." [95]

Carlson made significant use of statistical analysis, and he described its limitations in the discussion section of his dissertation. "Statistical analyses are not proof of a causal relationship; however, they do enable one to make probability statements about events in time and space, such as the association of fluoride with conifer foliage abnormalities, reduced radial and height growth, and other characteristics, and they can be used to support or refute hypotheses of biological events," he said. He also noted that his study did not measure airborne fluoride levels. Based on ground observations, tree mortality was about evenly distributed between western white pine, lodgepole pine and Douglas fir. Mortality estimates from aerial photographs only counted standing dead trees, but Carlson estimated many trees killed by fluoride in the past four to 10 years had fallen to the ground and were not counted. He also noted that forest resources other than trees were impacted by fluoride, including wildlife, soils, watershed, forage and recreation. Carlson also criticized the claim by biologists employed by AAC that western white pines in the area were killed by white pine blister rust, a fungus disease, calling the claim simply not true. Referring to his histological studies using laboratory testing of seedlings, Carlson said the controlled greenhouse study "showed rather conclusively" that non-pollutant causes of needle tip necrosis, such as drought, salt or cold, could be distinguished from necrosis caused by hydrogen fluoride, sulfur dioxide and reduced sulfurs. This was backed up by studies of specimens collected in Switzerland, Montana, California and Alaska. Some of those areas were near fluoride emissions. [96]

On Aug. 15, 1979, the defendants in the U.S. v. ARCO and Anaconda air pollution case filed a subpoena to depose Carlson in Missoula on Sept. 10, 1979. Carlson would be required to make available to the defendants any documents, maps, microscopic slides, photographs, raw data, aerial photographs, logbooks, diaries and computer inputs related to the case. [97] Two weeks later, federal and company attorneys debated before U.S. Judge Russell E. Smith about when Carlson should be deposed. U.S. Attorney for the District of Montana Robert O'Leary noted that Carlson's investigations would continue into the fall and it made more sense to depose him in November. Anaconda attorney Frederik Yerke objected, noting that Carlson's deposition "is probably the most important one that Anaconda will take in this case," adding that "the number one man is Dr. Clinton Carlson." Yerke recounted how in summer 1969, in the company of experts retained by AAC, Carlson "became aware, for the first time, of the evidences of alleged symptoms of fluoride damage because of what was pointed out to him at the time." Yerke noted that Carlson took samples in fall 1969 and sent them to the Wisconsin Alumni Research Foundation (WARF) for analysis. Carlson and Jerald Dewey conducted field studies in the Flathead Forest and Glacier Park in summer 1970 and again in fall 1971, and the results were published in two reports. Yerke said about six to eight studies and publications had been issued by the Forest Service on fluoride emissions and impacts. Judge Smith agreed that since Carlson was still conducting field studies, he would end up being deposed twice. It made more sense to depose him in November, the judge said. [98]

Carlson was deposed by attorneys representing AAC and the Anaconda Company at the U.S. District Courthouse in Missoula and at a forest laboratory in Missoula on Nov. 26, 1979 and again on Jan. 8, 1980. The transcript of the deposition ran to more than 800 pages and included 55 exhibits, with much of it focusing on Carlson's Ph.D. dissertation. Many of the questions were highly technical in nature, dealing with Carlson's statistical methods, his use of infrared aerial photography and other new techniques, and his conclusions about how much the damaged timber on Flathead Forest lands was worth. Attending the deposition were Steven Herman and Ezra Rosenberg, from the Justice Department; Fredric Yerke, an attorney from Portland, Ore.; Sherman Lohn, an attorney from Missoula; Robert Smith and Brigid Henrie, attorneys from Baltimore, Md.; and Don Ryan and Lee Smith, from the Anaconda Aluminum Co. Carlson defended his dissertation, noting that follow-up research by others backed up his conclusions, including studies by consulting forester Paul Kevin of San Francisco, who was hired by the Justice Department, not the Forest Service. He also noted that his dissertation had been looked at over and over again with a fine-toothed comb. [99]

When asked in the deposition if the dead trees seen in aerial photos could have been killed by something other than emissions from AAC, Carlson said looking into that general question would have required much more work but would only have fortified the case against AAC. He was asked if needle burn could be caused by other factors, such as insects, salt, herbicides, fire retardant, pesticides or other factors. He was asked about insect infestations in the same forest area in 1940 through 1954, before the AAC plant was operating. Carlson said he wasn't surprised to learn about those earlier infestations, but to have four insect species causing an epidemic in one area at the same time was unique. When asked if he was aware of sugar pine tortrix infestations in the same area during the 1960s and 1970s, Carlson said more research would be needed to conclusively show that fluoride damage led to the insect infestations. When asked about how his methodology and how forest inventory plots were assigned to isopols that indicated the amount of fluoride found in plants, Carlson said staff at the Glacier View Ranger Station did much of the work in determining the stands, adding that he believed the staff at the ranger station did a "credible job." When asked about comparing similar habitat-type plots and how he took into account aspect, soil and moisture, Carlson said those conditions could be inferred. When asked about historic fires, including the 1929 Half Moon Fire, Carlson said the fires left very little old growth trees on the east side of Teakettle Mountain. [100]

The Anaconda attorneys also asked about Carlson's previous work on air pollution emitted by other industrial facilities, including the Anaconda Company's copper plants and the Hoerner-Waldorf pulp mill in Missoula, a baseline study for a proposed magnesium plant in Addy, Wash., field studies for pulp mills in Sitka, Alaska, and Ketchikan, Alaska, several smelters in New Mexico and Arizona, the ASARCO smelter in East Helena, Mont., the coal-fired power plants in Colstrip, Mont., fluoride pollution in the Rhone Valley in Switzerland, and a phosphorus plant in Ramsey, Mont. Carlson said he also gave a presentation in Switzerland for the International Society for Fluoride Research using data from his AAC studies in the Flathead Forest. He also referred to additional studies of the area near the AAC smelter in Columbia Falls, including an ongoing wildlife study for Teakettle Mountain by Karen Zacheim and a meteorological study of the AAC area by Michael Williams. When asked about his statistical methodology in determining isopols, how his infrared photos mostly measured chlorophyll in the crowns of trees, and how his findings might be different if AAC had reduced fluoride emissions, Carlson agreed that not many other scientists used aerial photos the way he did, and not all dead trees in the photos were killed by fluoride, but he defended his conclusions based on his professional experience as a plant pathologist and his career in the Forest Service. [101]

Tree mortality did not occur overnight, Carlson said in the deposition, but "as a result of a number of years of fumigation by fluoride." He believed fluoride emissions from AAC peaked in 1973 and again in 1976 or 1977, and 80% of the mortality occurred after 1974. "That is my best guess," he said. When asked if he would be surprised to learn that 30% of the mortality occurred prior to 1971, Carlson said that was not a fair question, and he'd like to see that data before he would change his opinion. During his studies, Carlson concluded that trees in aerial photos with 10% infrared reflectivity were likely to die within five to six years even if AAC reduced emissions to a "tolerable" level. When asked what a tolerable level was, Carlson said maybe 200 pounds of fluoride per day. When asked if 300 pounds would be all right, Carlson said he'd stick with 200. When asked where he came up with that figure, Carlson said he based it on a 1971 study that hypothesized what kind of impacts to expect if the area was shrunk down to the west side of Teakettle Mountain only. He said it was a "gross calculation" only. [102]

When asked about discrepancies between observations by ground crews conducting a plot-by-plot review and observations made from aerial photos, Clinton said ground crews couldn't say what caused a tree to die, but his statistical methods could. His statistical method took into account how far trees were from the AAC smelter and how far trees were from a northeasterly line drawn from the plant, based on predominant wind patterns. Carlson also said ground crews performing stand analyses were not working for him but were doing routine work for the Forest Service. His methodology eliminated standing dead trees that died before the AAC plant was built, but many trees that died that long ago had already fallen. He said he traveled to certain forest stands and took photos from the ground to confirm his aerial photo observations. He also noted that a big difference was that ground crews counted standing trees that were actually dead, while his aerial photos counted trees that were actually dead and trees that were going to die soon. As a result, his numbers of dead trees were twice as high as what ground crews reported. When asked if dead trees were counted twice and if AAC would be charged twice for them, Carlson said, "That may be true in some cases. I'm not sure how often that occurred. It would be impossible to sort out." The attorneys also asked Carlson about his conclusions on how fluoride affected growth rates of lodgepole pines. Carlson said he still wasn't entirely sure if reduced growth rates were caused by fluoride, insects or something else, but if he could study other tree species not impacted by insects, then he could find out. Carlson also said he could not conclude for sure if fluoride impacts predisposed trees to insect attacks. He said he could not determine for sure the cause and effect in that case. [103]

Finishing up the conversion

Installation of the new dry scrubber system at the AAC smelter was completed and put online by Dec. 22, 1978. The conversion from the plant's original wet scrubbers to the new system began in 1976. By January 1977, about one-third of the plant's reduction pots were connected to the new system. The original wet scrubber system used fans to draw pot gas to 30 towers located in courtyards between the potrooms. The wet scrubber units in each tower used water and chemicals to treat the gases. The water was recirculated, and the dirt and sludge was pumped to a pond on the plant site. The new system used the same fans to draw pot gases to two large scrubber systems, one for the four original potrooms of the West Plant and one for the six new potrooms of the East Plant. Inside each dry scrubber, pot gases were forced through a fluid bed of alumina where fluoride in the pot gases combined with the alumina, making aluminum fluoride, which was then cycled to a large storage silo for use in the reduction pots. According to Britt Bell, the project engineer, the dry scrubber system was expected to clean the waste pot gases to a greater degree and save the company several million dollars per year. The total cost of installing the new system was $4.99 million. [104] Whereas the original wet scrubber system provided 95.6% elimination of fluorides in emissions, the new dry scrubber system was expected to provide 99.8% recovery of fluoride. [105]

On March 10, 1979, a helicopter from Rocky Mountain Helicopter of Provo, Utah, showed up at the AAC smelter to lift ten 2,500-pound exhaust stack extenders in place for the new dry scrubber units. When completed, the plant would have six 116-foot high exhaust stacks at the East Plant and four 76-foot high exhaust stacks at the West Plant. Additional work was being completed inside the potlines, which was "shrouded in a veil of secrecy because of an agreement under which the company acquired the technology to reduce fluoride output," the Missoulian reported. AAC had signed a confidentiality agreement with the Sumitomo Co. that prevented visitors from entering the plant. Fluoride emissions at the smelter were limited to 864 pounds per day. Plant engineer Lee Smith said that at times the plant emitted 2,500 pounds of fluoride in a day, but that amount decreased as more pollution control equipment was installed. The Montana Board of Health had given AAC until mid-1979 to meet the state standards, and General Manager Robert Sneddon said the plant should be able to meet that deadline by using the new Japanese reduction pot technology. [106]

Sneddon said a wet scrubber system tried in 1974 was a "total disaster." It required a large amount of water and was installed on the roof. "We had problems, fires starting and no results," Sneddon said. "It looked all downhill. The roof scrubbers were very costly, inefficient and did not allow us to meet state standards. We thought we would have to close the plant." The Sumitomo and Alcoa conversion project was estimated to cost $40 million. "The Japanese were like knights on white chargers," Sneddon said. "Things looked like they might work, and we agreed to try to do in two years what they had taken 12 years to do over there." He noted that Japanese interpreters were needed to bridge cultural differences between the Sumitomo engineers and local workers, but the interpreters didn't understand the process. "It has been like being on a railroad track," Sneddon said. "There is a main line and lots of spur lines, and we kept getting on spur lines. But I think we are on our way now." In addition to reducing fluoride emissions, the Sumitomo conversion would improve electrical consumption. "We thought at first about 18 percent, but because of having an older plant, it will probably be 12 to 15 percent," said Chuck Fisher, the plant's mechanical engineer. The reduction pots also were expected to last longer, but the pots would be more sensitive to temperatures and would require closer monitoring. AAC had taken the Japanese process and "ran with it before the ink was dry on the contract," Fisher said. "Then when we had early failures with the new ones, they really wondered if we were crazy. But we worked together and through some retraining and actually schools for the help, we all learned, and now things are clicking along." [107]

With the big conversion nearing an end by mid-1979, ARCO hired more workers to get the project completed on time. The AAC plant hit its all-time peak employment figure of 1,493 employees on June 30, 1979. The high figure was attributable to summer vacations and temporary student workers in addition to construction crews working on the Sumitomo conversion. [108] The stack extensions for the new dry scrubber systems were installed by mid-September 1979. They originally were scheduled for installation in

March, but faulty welds forced a postponement. The dry scrubber system needed to be shut down temporarily for the stack installation in March, but the Environmental Protection Agency prohibited the plant from operating without any kind of scrubber system during the agricultural growing season in the summer months, when fluoride could potentially get into crops intended for human or livestock consumption. As a result, the postponement continued to September. [109]

The Sumitomo conversion and new dry scrubber system were part of a much larger pollution control effort, AAC stated on Dec. 11, 1979, in response to the plaintiffs' third set of interrogatories in the federal lawsuit. The legal document was signed by Lee Smith of AAC and was supported by nine ARCO employees. According to the document, AAC's plan was to use the dry scrubber system along with various other improvements to bring the plant's fluoride emissions below 864 pounds per day. Among the various improvements was installation of new French-made ECL pin-pulling cranes to improve the efficiency of pin-pulling work; new alumina delivery trucks to keep reduction pots sealed; new aluminum fluoride delivery trucks for more accurate dispensing; replacing pine poles with air lances for extinguishing anode effects in reduction pots; and replacing tapping vehicles with tapping equipment mounted on cranes. Altogether the improvements would cost about $13.8 million, including $5 million for the new dry scrubbers. According to the document, these were state-of-the-art improvements and no further improvements were "technologically or economically feasible" or "in any way warranted or necessary for purposes of protecting public health and welfare." The Sumitomo conversion program was expected to cost $42.4 million, but the Japanese company could not guarantee that fluoride emissions at the AAC plant would be less than 864 pounds per day at full capacity, the document stated. AAC estimated that when all the work was completed, including the Sumitomo conversion, the plant could produce 173,600 tons of aluminum per year on average and a maximum of 175,550 tons per year. [110]

Progress at the smelter plant paralleled progress in the federal lawsuit and changes in the surrounding environment. On Feb. 22, 1979, Glacier Park Superintendent Phillip Iversen wrote to National Park Service Rocky Mountain Region Director Glen T. Bean about a meeting on Feb. 2 with AAC plant managers Robert Sneddon, Lee Smith and Don Ryan. Glacier Park Air Quality Coordinator Robert Hall also attended the meeting held at the Park's headquarters building. "We delicately avoided discussing legal technicalities of the lawsuit between the government and Anaconda over levels and damages from fluoride emissions," Iversen said. "By the way, Glacier National Park learned about the lawsuit involving the Park from stories in the local newspapers on November 8, 1978." Iversen said he told the AAC officials that he had noticed an increase in fluoride levels despite progress in installing new air pollution control equipment at the plant in Columbia Falls. The officials explained that fluoride emissions had increased to 4,000 pounds per day at times during 1978 compared to 1,500 pounds in 1974. The Sumitomo conversion was about two-thirds done, all the new equipment was expected to be in place by the end of 1979, and fluoride emissions should comply with the 864 pounds per day state limit by the end of 1979, they said. Iversen pointed out to Bean that the complaint filed against AAC by the Justice Department had proposed reducing fluoride emissions to 200 pounds per day or else vegetation on public land would continue to be injured. Iversen was curious about the 864 pound figure versus the 200 pound figure. "Perhaps there is a legal stratagem involved here that we laymen are not privileged to," he told Bean. "As a matter of fact, no one, legal counsel or otherwise, has discussed this case with me." [111]

Iversen was not the only federal employee feeling pressure from the federal lawsuit. On May 7, 1979, Deputy Regional Forester Al Troutt, at the Region 1 offices in Missoula, spoke over the phone with Glacier Park engineer Keith Fellbaum about the lawsuit. Troutt said he had received 23 pages of interrogatories from AAC attorneys requesting details on how many trees were impacted, the tree diameters, species and ages, and other factors. Troutt said the Forest Service wanted to meet with Robert Hall to discuss how those questions would be answered. "At this meeting, the questions would be analyzed and a determination would be made as to who would answer what," Fellbaum reported Troutt saying. [112]

Rep. Pat Williams commented on the federal lawsuit when addressing members of the aluminum plant's union on Aug. 9, 1979. Reading a letter he had sent to Agriculture Secretary Bob Bergland, Williams said he told Bergland that AAC had made good progress in reducing fluoride emissions, and the big conversion was about 75% completed at a cost of $45 million. Williams said the target date for completion was May 1980, at which point the AAC plant expected to be able to comply with state Air Quality Bureau standards of 864 pounds per day. Williams pointed out that the national standard for fluoride was 1,600 pounds per day, twice the Montana level. Williams argued that the 200 pound-per-day standard called for in the federal lawsuit was unrealistic and unfair. Citing economic hardships which would be felt by the workers if the plant was forced to close or reduce production, Williams called for the smelter to be regulated by state standards and not the standard requested in the lawsuit. [113]

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[101] Deposition, Dec. 21, 1979 [AL4634]

[102] Deposition, Dec. 21, 1979 [AL4634]
[103] Deposition, Dec. 21, 1979 [AL4634]
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[107] Speelman, March 11, 1979 [AL5357]
[108] "$1 million expansion, Anaconda work planned," Hungry Horse News, Aug. 9, 1979 [AL0503]
[109] Anaconda waits to place stack" and "Pollution bill becomes law," Hungry Horse News, May 10, 1979 [AL0498]
[110] Defendants' answers to plaintiffs' third set of interrogatories in U.S. v. Atlantic Richfield Company and Anaconda Company No. CV-78-80, National Archives and Records Administration, Denver, Colo., Dec. 11, 1979 [AL5549]
[111] Memo from Glacier National Park Superintendent Phillip Iversen to National Park Service Regional Director Glen T. Bean, Rocky Mountain Region, Feb. 9, 1979 [AL5476]
[112] Record of phone conversation between Al Troutt, U.S. Forest Service Deputy Regional Forester for Region 1, and Glacier National Park engineer Keith Fellbaum, May 7, 1979 [AL5477]
[113] "Pat Williams proposes higher emission levels," Hungry Horse News, Aug. 16, 1979 [AL0504]