Chapter 37
The big variance

It took about a decade from the time public concerns over air pollution in Montana reached a level that led to a Clean Air Act in 1967 and the development of air quality standards that limited fluoride emissions from aluminum smelters beginning June 30, 1973. What came next was a long protracted process in which lawyers, scientists and politicians negotiated a way to keep the Anaconda Aluminum Co. smelter operating while an effective pollution control system was discovered and implemented. A key part of the negotiation was defined by the relatively new state environmental legislation, while the trial-and-error process conducted by AAC engineers proved to be technically difficult. What made matters especially frustrating for plant engineers was that a solution to the pollution was known, but it was too expensive and time-consuming for the Anaconda Company to initially accept. The plant engineers' task was to find a different fix that was cheaper and faster.

As the deadline for meeting the state's fluoride standards approached, the Anaconda Aluminum Co. publicly acknowledged that an air pollution problem existed. On Feb. 9, 1972, the Hungry Horse News interviewed AAC President Joseph B. Woodlief and Don Everett, vice president in charge of operations at the smelter in Columbia Falls. There was much concern in the local community that, with the nationalization of the Anaconda Company's Chuquicamata copper mine in Chile, a major setback, the aluminum plant might soon shut down. Woodlief said that he had just met with management and union leaders at the smelter where they had discussed the plant's future. Top on the list was compliance with pollution control regulations. "There is now comparative fluoride emissions with five potlines to what there was when the plant in its early years had only two," Woodlief said. He believed the aluminum plant could not possibly comply with the state's proposed emission limit of 864 pounds of fluoride per day without completely rebuilding the plant. The next biggest concern for locals was the company's new aluminum smelter in Sebree, Ky. "Having two aluminum production plants will round out our operation," Woodlief assured locals. "One plant is not sufficient, and we become a metal purchaser." [1]

The deadline for AAC to meet the state's new fluoride emissions standard was June 30, 1973. Even if the Anaconda Company found a pollution control system that could reduce its fluoride emissions at full capacity to 864 pounds per day and had the financing to pay for it, construction of the new system would take a long time – especially if it meant rebuilding the plant, as Woodlief suggested. The Anaconda

Company had requested short-term variances for its rod mill at Columbia Falls in July 1970 and May 1971 as it tested new processes for treating molten aluminum that was made into rod and wire shapes. On May 18, 1973, the Montana Board of Health granted another variance to the Anaconda Wire and Cable Co. for visible emissions from the rod mill. The variance gave the company one year to test a British invention expected to reduce chlorine fluxing emitted to the air. [2] But by June 22, there was no word from AAC about whether it would seek a variance from Montana's new fluoride emissions standard. It was thought by some that the company might not even try to obtain a variance from a regulation that it believed was impossible to achieve. [3]

The AAC position

AAC had spent $1 million installing new scrubber equipment in 1970 through 1971 that reduced emissions from 7,500 pounds to 2,500. According to some experts, most of the fluoride emissions from the smelter were not visible – the haze seen hanging over the plant, especially when the air temperature reached 32 degrees and no weather inversion was in place, reportedly was caused by carbon particulates. The smelter was considered to be in violation of the state's regulation on particulates, and no improvements in particulate emissions had taken place. Montana's fluoride emissions standard was considered the strictest in the nation, and AAC management considered the 864-pound limit a technological impossibility. John Bartlett, a member of the Montana Board of Health, told the Hungry Horse News that the new standard was intended to encourage AAC toward compliance, and that variances were available to allow the smelter to keep operating until technological improvements made the new standard a possibility. By June 1973, AAC had provided the government no definite plans on whether it would seek an air pollution variance. According to Benjamin Wake, administrator of the Environmental Sciences Division of the Montana State Department of Health and Environmental Sciences, three options existed: 1) AAC could seek a variance; 2) the Board of Health could revise the standards; or 3) the board could take legal action to force the plant to comply. "We are not aiming to close anyone down, but at the same time, progress and pollution control must go on," he said. [4]

On June 30, 1973, AAC petitioned the Montana Department of Health and Environmental Sciences and the Montana Board of Health for an air pollution variance from the new fluoride standards. The petition was signed by Woodlief, AAC General Manager Ed Woster, Anaconda Company Chairman John B.M. Place and AAC's chief counsel, Krest Cyr. [5] Cyr was appointed vice president and counsel for the Anaconda Aluminum Co. in Louisville, Ky., in January 1972. At the time, he was an Anaconda Company vice president and a resident of Santiago, Chile. He had served as the U.S. Attorney for Montana and as an attorney for the Montana Power Co. [6] AAC requested a

one-year exemption from the state's new fluoride emissions standards during which time the company proposed to "continue its efforts to develop technically and economically feasible solutions to further control its emissions from the Columbia Falls aluminum reduction plant, including in particular the purchase and installation of a foam scrubbing equipment pilot unit." The petition stated that the plant could only meet an emission requirement of 2,500 pounds of fluoride per day in gaseous or particulate form, but the petition also claimed the plant's operations "do not constitute a nuisance" and that no harm to public health or safety would result from granting the variance. [7]

"Petitioners' operations do not constitute a nuisance," AAC's petition stated. "There are no effects on human health or safety which result from the plant's emissions of fluorides and particulates. Ambient air samples at the highest levels of concentration sampled within vicinity of the plant range between 0.1 parts per billion to 3.5 parts per billion at a maximum. These levels are far below those at which any effect on human health or safety would be experienced. Not a single case of fluorosis in humans has been encountered in the plant's history, nor has any other adverse effect on human health or safety been shown to exist." AAC claimed that additional pollution control would benefit interests other than human health and safety. "Benefit in terms of reduction of air contaminants would be mainly aesthetic and confined to the local vicinity of the plant itself," the petition said. "As indicated above, there is no damage to human health or safety; nor is there any danger from eating plants or vegetation grown in the Columbia Falls area." [8]

The petition also stated that numerous air pollution damage lawsuits against the plant were pending, totaling about $3.5 million. The 18-page petition explained in detail the history and operations of the plant and the types of modifications that had been made to existing pollution control equipment. The modifications included improving gas flow in the ductwork, a new design for the gas burners mounted on each end of the reduction cell to deal with carbon monoxide and hydrocarbons, improved operating techniques, cleaning of scrubbers and ductwork, widening of anodes, adding cooling fins to the anodes, and the installation of computers for process control. Numerous tests had also been performed, some without success. The petition listed three alternative solutions. The first, converting the plant from Soderberg pots to prebake pots, would cost about $80 million, which was ruled out as prohibitively expensive. The second was the installation of rooftop wet scrubbers. This alternative was rejected because the scrubbers would freeze in winter time and because pitch present in potroom fumes would collect on the scrubber system's fans, increasing maintenance costs. The petition cited the case of the aluminum smelter at The Dalles, Ore., where the rooftop scrubber system was down for two months in 1972 because of freezing weather. The third

solution, the use of rooftop foam-based scrubbers, was preferred by AAC. The company had ordered a $50,000 unit for testing, and it was expected to arrive by August 1973. If the unit operated satisfactorily, then more would be ordered and installed. It was estimated that a rooftop foam-based scrubber system for one entire potroom would cost about $1.45 million. [9]

According to the petition, AAC's plan called for installing a foam-based scrubber on 60 feet of one roof line and, if it worked properly, installing additional units until the plant's fluoride emissions met Montana's standard. Pollution control equipment had been installed at the Columbia Falls smelter from the beginning, the petition explained. In 1955, AAC had installed cast-iron skirts on pots to capture gases in an effort to reduce secondary emissions through the rooftop clamshell vents. Later when the plant grew to 10 rooms, ducting, fans and multiclones were installed to capture particulates in primary emissions, the pot gases from the reduction cells. The plant had 30 wet scrubbers to remove fluoride from primary emissions. The cost of the additional equipment was $5.9 million, with an additional $1 million spent on testing and research, and $125,000 on equipment for testing and monitoring, the petition stated. Maintenance ran to about $1 million per year. The result was that by 1969 emissions were reduced to about 7,500 pounds of fluoride gas and particulates per day. After 1969, the company spent another $1 million and reduced emissions to 2,500 pounds per day. [10]

AAC's petition described expenditures from 1969 through 1973 that included hiring a consultant to inspect the ducting system, which was said to be adequate – a test concluded that doubling the gas flow rate from each pot to 600 cubic feet per minute would reduce pot efficiency. Consultants from American Air Filter Corp., Ducon Corp., Pulverized Machinery and others came to the plant but did not make any reasonable and workable suggestions. New designs for the burners at each end of the pot could not show an improvement. Use of standby fans in each scrubber unit to increase airflow was successful and led to the installation of pilot venturi scrubber units, one from Ducon and one from American Air Filters, and the installation of 28 more venturi units in April 1971 at cost of $577,756, which improved fluoride removal from 89% to 99%. Pot tending operations were improved, with potroom workers sealing the crust, dealing with "sick cells" and regular meetings to improve training. Crews were established to clean pot gas ducting and scrubbers, which increased to 15 workers. The "gooseneck" section of the pot gas ducting had been leaking and was wrapped in asbestos at a cost of $35,600. [11]

Fluoride emissions at the smelter had been reduced by 1970 from 7,500 pounds per day to 5,000, according to AAC's petition, but after venturi scrubbers were installed, fluoride emissions fell again from 5,000 pounds per day to 2,500. AAC personnel visited

aluminum plants in Europe, Canada and the U.S. to look at rooftop control systems, but "nothing was discovered which would control the roof emissions of the vertical-stud Soderberg at Columbia Falls within Montana's prescribed limits," the petition stated. Tests determined that wider anodes would reduce temperatures at the top of the anode and so reduce particulates being drafted to the rooftop clamshell vent, and they were widened at a cost of $229,200. Aluminum fins were imbedded in the anode paste at the top of the anode to cool the carbon paste, but the effect was not significant. Steel anode pins were replaced after five inches had burned off rather than seven inches, which reduced the temperature of the Soderberg anode and lessened the amount of hydrocarbons emitted to the potroom. Computers were installed on potlines for better control of voltage levels, which resulted in fewer "sick cells," at a cost of $600,000. A drain line pump installed on the wet scrubbers allowed maintenance to take place without shutting the scrubbers down. Experiments using petroleum pitch and fluid coke to make anode paste were being studied as a way to reduce hydrocarbon emissions. Freezing-cold winter weather and the presence of pitch fumes from the Soderberg anodes ruled out the use of rooftop wet scrubbers, but their effectiveness was not certain. "Perhaps most discouraging of all the factors is the simple fact that even if the roof scrubbers were installed, they would not be capable of meeting the Montana standard," the petition stated. The third air pollution control alternative was foam scrubbing equipment. [12]

AAC also described the economic benefits provided by the Columbia Falls smelter. "Since opportunities for employment are very limited in the valley, and there is already substantial unemployment in the valley, the closing of the plant would result in unemployment for most of these workers," AAC said in the variance petition. The workers' $9.5 million in salaries and wages was multiplied in the local economy 7 to 10 times, "and its absence would certainly cause a depression in the economy of the Flathead Valley." In addition, AAC paid $1.38 million in ad valorem taxes, not including state and federal income taxes, or about 14.3% of the county's tax revenue. "Loss of this revenue would mean cuts in school budgets, highway and road construction and maintenance, social services, and all public activities of the county," AAC said. "At the same time, the burden on public revenues would be increased by the welfare and unemployment compensation payments resulting from closing the plant." Closing the plant would also affect 1,754 Anaconda employees across the U.S. who used the aluminum produced in Columbia Falls to make other products and who earned about $20 million per year. The Anaconda Company had depreciated capital investment at the Columbia Falls plant worth about $67 million and another $32 million in fabricating facilities elsewhere. Other economic impacts would include loss of revenue to suppliers, local or otherwise, and U.S. aluminum production. "Aluminum is a vital metal in the nation's economy," AAC said. [13]

In a variance request document signed by Woster on June 30, 1973, the company weighed the costs and benefits of additional air pollution control. “There would be little advantage to the Flathead Valley or the state of Montana from requiring a closing of the plant,” Woster said. “Benefits in terms of reduction of air contaminants would be mainly aesthetic and confined to the local vicinity of the plant itself.” Woster went on to say that “there is no damage to human health or safety; nor is there any danger from eating plants or vegetables grown in the Columbia Falls area.” He noted that, “According to several experts on vegetation, the paving of dusty streets in Columbia Falls would do far more to improve the health of the vegetation in the Columbia Falls area than the closing of the aluminum plant. The amount of damage done to vegetation, which is speculative, would in any case be a tiny fraction of the economic impact which the closing of the plant would cause.” [14] Once granted, the Anaconda Company later renewed its variance with requests filed on April 18, 1974, April 28, 1975, March 23, 1976, April 4, 1977, April 3, 1978, and Sept. 24, 1979. [15]

The state’s position

The May 20, 1974 Final Environmental Impact Statement written in response to AAC’s variance request, completed by the Montana Department of Health and Environmental Science, provided an in-depth review of the AAC plant from the science of aluminum smelting and emissions to the latest in pollution control technology, as well as the plant’s history and economic impacts. The main pollutants from the aluminum smelter were gaseous and particulate fluorides, aliphatic and aromatic hydrocarbons as particulate, and raw material particulate, MHDES staff said in the Final EIS. Emissions from the carbon paste plant occurred at several locations and included coke dust at the unloading facility. Emissions at the metallurgical coke dryer were scrubbed by a venturi scrubber installed in 1972. Emissions from the aluminum reduction cells consisted primarily of fluoride as gas along with cryolite, chiolite and aluminum fluoride as particulates. In 1971, it was estimated that the plant used about 110 pounds of cryolite per ton of aluminum produced. Thus, the amount of fluoride emitted by the plant as a whole was directly related to the production level. The pot gases could contain fluoride in a wide number of compounds, as well as carbon dioxide and carbon monoxide. Special burners mounted at each end of the reduction cell served as after-burners to complete combustion of pot gases. [16]

Emissions from the anode at the top of the reduction cell included aromatic hydrocarbons and other volatile compounds coming from the coal tar pitch used to bind the anode paste. Those emissions ended up in the potroom, according to the Final EIS. Particulates were also created by work done to make the reduction cell work perform efficiently. Other sources included volatilized bath and pot crust material that escaped

into the potroom air. It was estimated that about three pounds of alumina escaped into the air per ton of aluminum produced. [17] The heat of the reduction process released aromatic hydrocarbons and other volatiles into the potroom as the carbon paste was baked inside the Soderberg anode. Anode emissions were considered a significant source of carcinogenic organic compounds, and the blue haze typically seen near aluminum plants was attributed to hydrocarbons emitted at the top of the anode. The carbon paste plant, which produced carbon briquettes for the anodes, used cyclones and baghouses to control coke dust emissions during unloading, transferring and processing. A venturi scrubber was installed at the paste plant in 1972 to control dust emissions from the metallurgical coke dryer. Despite these controls, carbon dusts continued to be emitted by the paste plant in 1974. [18]

The state's version of pollution control efforts by AAC was described in the 1974 Final EIS. The AAC plant's original pollution control system in 1955 used multiclones and low efficiency wet scrubbers. When a third potline was added in 1965, the same kind of pollution control equipment was installed. The Montana Board of Health adopted fluoride standards for air quality in 1967. Two more potlines were added to the AAC plant in 1968. At that point, an estimated 7,500 pounds of gaseous and particulate fluoride was emitted per day, at the rate of 15 pounds per ton of aluminum produced. With new pollution control equipment in place after the five potlines were operating, AAC claimed it had reduced fluoride emissions to 5,000 pounds per day, or 10 pounds of fluoride per ton of aluminum produced. In May 1970, the Montana Board of Health and Environmental Sciences established fluoride emission standards for existing aluminum plants to be in effect by June 30, 1973. AAC then installed some new venturi scrubbers with packed towers, and by early 1972 claimed it had reduced fluoride emissions to 2,500 pounds per day, or 5 pounds per ton of aluminum produced. Particulate emissions, however, were estimated to be 6,500 to 8,500 pounds per day. [19]

According to the Final EIS, the chemicals found in cell emissions originated inside the reduction pot, which was normally sealed by the anode skirting and a crust that formed over the hot bath. Cell emissions ordinarily were directed through the flue system to the scrubber towers, but they were released into the potroom when the crust was periodically broken by pot tenders. According to AAC data, gaseous hydrogen fluoride made up about 90% of the cell emissions. Fluorine was the most electronegative of all elements, and therefore extremely reactive and not found in its elemental state either in nature or in pot gases. The remaining 10% of all cell emissions was made of 60% cryolite, 20% chiolite and 20% aluminum fluoride – chemicals found in the molten bath. Pot gases might also contain particulates such as carbon, sodium fluoride, calcium fluoride, alumina and various complexes of sodium, aluminum or calcium with fluorine. Pot gases might also contain gaseous emissions including carbon tetrafluoride, silicon

tetrafluoride, carbon disulfide, carbonyl sulfide, hydrogen sulfide and sulfur dioxide, as well as large quantities of carbon monoxide and carbon dioxide, along with tarry hydrocarbons from the anode. [20]

An oversimplified way to estimate fluoride pollution at an aluminum smelter, according to the Final EIS, was to say the more electrical power consumed, the more aluminum produced, and the more aluminum produced, the more fluoride emitted. Cell factors that also affected the amount of fluoride emissions included cell design, bath temperature, the ratio of chemicals in the bath, the alumina concentration in the bath and the DC electric current flux. Based on the current efficiency of the AAC reduction pots – the amount of electrical current needed to produce a given amount of aluminum – the state concluded that the AAC plant operated in the "middle of the road" among other aluminum producing plants, neither at maximum production rates or at minimum pollution rates. [21]

The variance process

AAC's variance request set in motion a bureaucratic procedure that involved numerous lawyers and scientists on both sides in a process that was relatively new. The National Environmental Policy Act, which established the NEPA process on a federal level, was enacted on Jan. 1, 1970. NEPA's most significant outcome was the requirement that all executive federal agencies prepare environmental assessments or environmental impact statements to state the potential environmental effects of significant federal agency actions when they were proposed. [22] The Montana Environmental Policy Act was enacted in 1971 and paralleled the federal legislation. Environmental assessments or environmental impact statements were required under MEPA when state agencies took significant actions. [23] Granting a variance to the Anaconda Aluminum Co. that would allow its smelter to continue emitting fluoride in greater amounts than allowed by the state's new air quality standards was clearly a significant action by a state agency, but the manner in which environmental review documents would be drafted under MEPA was still being developed, and the AAC variance became a major undertaking.

On July 10, 1973, John Lepley, an attorney at the Montana Department of Health and Environmental Sciences, wrote to Irwin Dickstein, another MDHES attorney, about legal issues to be expected in AAC's application for the air pollution variance. He noted that AAC had already requested a declaratory ruling, but the company's petition "clearly shows that the company does not have definitive control plans." AAC wanted the state to postpone enforcing the new fluoride standards until June 1974 so smelter personnel could test its new foam scrubber system. Lepley noted that "much of the petition evidently is designed to show that the company is concerned and has done a great deal already." The petition also showed that AAC wanted to take advantage of Montana law

"to the extent it provides for a balance between cost to the company and benefit to the public," Lepley said. He also noted that AAC had talked about the possibility of shutting down if they could not find a solution. "They seem to threaten a close-down of the facility with a resulting loss of employment in the area," he said, adding, "In short, they seem firmly entrenched in the position that they are doing the best they can and won't go any faster." [24]

Lepley noted that the Anaconda Aluminum Co. had wanted the Environmental Protection Agency to grant the variance, but that wasn't allowed under the law. MDHES needed to recognize a number of factors, Lepley said: 1) AAC was not likely to meet the state's fluoride emission standards by July 31, 1975 or even 1976; 2) that basing the standard on production weight was "probably not enforceable"; 3) the AAC plant should not be closed down unless absolutely necessary in order to meet U.S. standards; 4) nobody at MDHES or the EPA really knew what the ambient air quality was in the area for particulates; and 5) there was a Clean Air Act violation, so MDHES should be taking appropriate action. Based on all that, Lepley's expectations were: 1) MDHES would face a strong fight; and 2) they would probably lose, so the state needed to look at regulating particulates, which in Columbia Falls could result from tepee burners, dusty streets, slash burning and the AAC plant. "Perhaps control of the first three would be sufficient to attain standards," he said. He also noted that construction of a new fiberboard plant in Columbia Falls would likely eliminate the tepee burners because the fiberboard plant would utilize waste wood from timber mills. [25]

James Robischon, a Butte attorney working for the Anaconda Company, described his expectations from AAC's application for an air pollution variance in a Nov. 21, 1973 letter. The petition was in its nature a civil complaint or responsive pleading, he said, so the issues could be developed by the discovery process. It was a contested case, so due process applied. He said he wanted a hearing to be held in front of the state examiner in Columbia Falls or Kalispell where people who are "likely to be affected" live. AAC also was entitled to a hearing separate from any hearing for the Anaconda Company's copper smelters or from any hearing for ASARCO's lead smelter in East Helena because different issues were involved, Robischon said. He noted that MDHES had already decided on completing an environmental impact statement before a decision was made. Robischon said he was against taking the variance request to the Montana Legislature because that would violate due process. [26]

As the state worked on a draft environmental impact statement for AAC's variance request, it collected information from smelter personnel. On Oct. 17, 1973, AAC Environmental Manager Warren Hook sent answers in an affidavit to the MDHES about air pollution control work at the AAC plant. Hook said 1972 had been a typical year for

plant operations, but higher power costs made 1973 not typical, so he would provide 1972 data. Hook said about 430,000 anode effects occurred each year, with a typical duration of three minutes apiece. Anode effects occurred when gas built up beneath the anode and created more electrical resistance, which in turn increased reduction cell voltage and bath temperature. Emissions typically increased during anode effects. About 2.55 million cubic feet of potroom air passed through the rooftop vents each minute, based on a monthly average for all 10 rooms, Hook said. Pot gas from a typical reduction cell was 90% gaseous hydrogen fluoride. The amount of fluoride going into the pot gas collection systems was 1.8 pounds per hour per cell. He noted that AAC did not consider that figure to be "exact, reliable or definitive," he said. One Temperator foam scrubber had been installed near a rooftop clamshell vent to control secondary potroom emissions and was being tested. This type of pollution control equipment never before had been used in an aluminum plant, he said. All process water was recycled, he said. Aluminum production averaged 29,775,352 pounds per month in 1972. Total capital investment in the AAC plant since Jan. 1, 1964 was about $75.7 million. The amount invested since Jan. 1, 1969, was $8.4 million, Hook said. [27]

The state's draft environmental impact statement was issued on Feb. 7, 1974, and an agency review process began. By that time, AAC reported that fluoride emissions for the last half of 1973 had fallen to 1,448 pounds per day, but production of aluminum during that time period also had fallen as the company curtailed production at the smelter. According to the state, no real reduction in fluoride emissions had taken place at that time that would reduce emissions at full production levels. [28] In mid-February, MDHES announced that a public hearing had been scheduled for March 18 to consider amendments to the state rule which set fluoride emission levels for primary aluminum smelting plants at 0.060 pounds per hour per reduction pot, which amounted to 864 pounds per day for the plant's 600 pots. [29] By March 1, the Draft EIS was made available to the public for review and comment. MDHES recommended in the Draft EIS that the state Board of Health deny the variance request. Draft EIS documents for air pollution variances for the Anaconda Company's copper smelter and the ASARCO smelter in East Helena were also made public, and MDHES also recommended denying variances for those two requests. [30] In late March, the Flathead County Commissioners sent a letter to MDHES in support of the AAC plant's request for an air pollution variance. The commissioners noted the importance of the plant in the local economy. [31]

Denial and deadline

The final environmental impact statement for the Anaconda Aluminum Co.'s variance request was issued on May 20, 1974. By that time, the smelter in Columbia Falls was emitting an estimated 1,855 pounds of fluoride per day as it continued to be in partial

curtailment. A decision on the variance would be made 30 days after the Final EIS was issued. The variance dealt with fluoride emissions, particulate emissions and visible emissions. “The company has proposed certain actions in lieu of compliance,” MDHES staff said at the start of the Final EIS document. “The Anaconda Aluminum Co. has provided no assurance of compliance, at any time. Present emissions continue to damage vegetation and subject people and animals to the risk of adverse effects. The need for emission control and compliance has been clearly demonstrated. Control technology sufficient to comply with the regulations exists and is in use today. The cost of such control is commensurate with other plants’ pollution control expenditures. The department therefore will recommend to the Board of Health and Environmental Sciences that the variance request be denied.” [32]

According to the Final EIS, evidence from three sampling stations that had monitored fluoride emissions from the aluminum smelter for five years showed that emissions continued to exceed state standards by substantial margins despite some reductions. The stations on Teakettle Mountain, which MHDES staff described as a “barren” mountain, showed levels of fluoride exceeding state standards by a factor of 30. The limited sampling conducted inside Glacier National Park showed gaseous fluoride levels to be below the state standard, but vegetation in the Park was being damaged by continuing accumulations of fluoride. The state acknowledged that little research had been done on the health effects of airborne fluoride on humans, but it was believed that fluoride, like mercury, was concentrated by upward movement through the food chain and would be found at higher levels among people living under the influence of fluoride emissions. The negative effects of airborne fluoride on cattle were well-documented, the EIS stated, and it was generally accepted that fluoride uptake by cattle was not by inhalation but by ingestion of fluoride-affected feed or water. Fluorosis had been studied in cattle in Tennessee, and most studies showed that cattle tended to accumulate fluoride more readily than other kinds of livestock. The effects of fluorides on animals were similar to that on humans, and the greatest impacts occurred to the young with developing skeletal structures. [33]

To protect livestock, Montana had adopted a standard for fluoride content in forage of 35 ppm, the Final EIS stated. Much of the vegetation in the area around the AAC smelter had accumulated more than 35 ppm fluoride, and in some cases the amount was several factors of 10 in excess of 35 ppm. Of the 10 deer collected in the upper Teakettle Mountain area, most manifested tooth damage and significant osteofluorosis of the femur bone. Generally, fluoride content decreased with distance from the AAC plant. The negative effects of airborne fluoride on vegetation had been studied by scientists for many years, and aluminum reduction facilities were known to be a source of hazardous fluoride levels. Some plants were more sensitive to the effects of airborne

fluoride, and many of the plants found in the vicinity of the smelter fell into that category. Fluoride was absorbed into trees as a gas or as a particulate dissolved in water. Critical levels of fluoride affected the needles of conifers and the leaves of deciduous trees. Negative impacts by AAC fluoride emissions had been be documented by AAC, MDHES, the Forest Service and the University of Montana. All of the studies were made in timbered country to the east, and none to date had been made in the Flathead Valley, the Final EIS stated. [34]

MDHES responded in the Final EIS to AAC's claim that no evidence existed showing human health was threatened by the smelter's emissions. It began by noting that "very little research has been done relating to ambient air concentrations (of fluoride) to effects on humans." It noted that hydrogen fluoride gas was a pulmonary irritant, but that more damage occurred in the calcified structures, such as bones and teeth. The Final EIS went on to note that the American Conference of Governmental Industrial Hygienists had published allowable limits of fluoride for occupational exposures, and that the Montana ambient air standard of 1 ppb would amount to about 2% of the average daily intake. On the other hand, MDHES said, "It has been observed that fluorides, like mercury, are concentrated in the food chain; therefore, persons residing under the influence of fluoride emissions may accumulate significant quantities in the body from water, locally raised fruits, vegetables and livestock. Occupational exposures also could contribute to the total dose." MDHES went on to discuss the impacts of particulates, noting how bad the particulate problem was in Columbia Falls due to unpaved streets and timber mills. But, the Final EIS noted, "Possibly more significant is the presence of polynuclear aromatic hydrocarbons (PAH) of a carcinogenic nature (benzo-a-pyrene, benz-k-fluoranthene, etc.)." MDHES noted that the coal tar pitch used to make carbon anode paste "is composed almost entirely of polynuclear aromatic compounds." Another hazard posed by coal tar pitch was "photosensitization," caused when workers' skin was burned by the sulfur in the fumes. The effect was similar to sunburn. [35]

MDHES also questioned the fluoride emission data provided by AAC plant personnel. AAC claimed in the Draft EIS document that its fluoride emissions for the second half of 1973 were 1,448 pounds per day, but plant production had been curtailed from 500 tons of aluminum per day at total capacity to 380 tons. The state's new emissions regulation limited the plant to 1.73 pounds of fluoride per ton of aluminum produced, so the smelter's total emissions were required to be less than 657 pounds of fluoride per day at the reduced production level in the second half of 1973. In addition, MDHES estimated that the combined pollutants from primary and secondary emissions added up to 1,855 pounds per day. AAC was only using a primary collection system, collecting pot gases but not secondary potroom gases. "AAC's primary system is relatively

efficient, although some other plants have better systems," MDHES said in the Final EIS. "Some improvements might be made to the AAC system, but even zero emissions from the primary system would not bring the plant into compliance." [36]

MDHES said in the Final EIS that it would not suggest any specific engineering solution for the aluminum plant's pollution control system, nor would it suggest that an "off the shelf" system would work. MDHES recognized that AAC would need time to perfect a good system. Therefore, MDHES recommended a timetable: 1) a control plan to be submitted to MDHES by July 31, 1974; 2) all contracts for pollution control equipment to be concluded by Dec. 31, 1974; 3) on-site construction of new equipment to be initiated by March 31, 1975; 4) on-site construction to be completed by May 31, 1976; and 5) compliance with state air quality standards to be achieved by July 31, 1976. "The guiding precept of public health work has been and will continue to be to err on the side of protecting the public environment until it can be affirmatively demonstrated that such protection is unnecessary," MDHES said. "Consistent with these policies, the air pollution control program in the state of Montana has promoted and should continue to encourage and, in many cases, require the use of the most advanced technology available for the control of air pollutants." After a review of pollution control equipment at other aluminum plant, MDHES concluded, "Existing technology appears efficient enough to achieve compliance with the regulations." [37]

In its petition for a variance, AAC had provided three options to deal with the smelter's emissions problem – convert the plant to a different type of aluminum reduction process, install scrubber systems on the roofs of the potrooms or develop a new type of scrubber system. AAC had requested a variance for a year to allow time to study a new type of scrubber system, but MHDES staff noted in the Final EIS that the petition contained no provision or prediction for eventual compliance, and that the company reserved the right to determine the technical and economic suitability of the pollution control technology being studied. At the time of the variance request, AAC had installed a new type of wet-scrubber system on the roof of a potroom as a pilot test. Called a Foamator and designed by the Alfa-Laval Group of Sweden, the device may have been used at an aluminum plant in Russia. Wet-scrubber systems required large quantities of water and posed a wastewater treatment problem for AAC, which would not be allowed to discharge the wastewater into the Flathead River system. The AAC Foamator study was conducted in cooperation with Alcoa and Alfa-Laval, and AAC was reluctant to divulge information about the system to the state. However, at a March 18, 1974 Montana Board of Health hearing, the company claimed the Foamator system was capable of removing 85% of fluorides and 75% of particulates. The company also agreed to let the state cooperate in the testing of the system. AAC scheduled construction of a

60-foot long section of the new rooftop wet scrubbers beginning July 1, 1974 and, depending upon the success of the system, adding more sections for more testing. [38]

MHDES staff believed the Foamator tests were not enough. There was no assurance by AAC that the entire plant eventually would be controlled, nor was any time table set for additional installations. Moreover, AAC had made no provisions for alternate strategies for compliance. “Any analysis of the impacts of granting the variance as Anaconda Aluminum has requested would be hypothetical as no definite plan for emission control has been proposed,” the Final EIS stated. “What is proposed is a study program, with hardly any commitments to emission control. Apparently a significant factor is whether the secret process will be saleable.” MHDES staff added, “The population would continue to be subjected to potentially hazardous carcinogenic agents, high levels of short-term suspended particulate, and the accumulation of fluorides.” The Final EIS cited Montana’s Clean Air Act and its policy to “prevent injury to plant and animal life and property, foster the comfort and convenience of the people, promote the economic and social development of this state and facilitate the enjoyment of the natural attractions of the state.” [39]

The economic position

The state agreed that using existing air pollution control technology might not solve the problem and addressed the issue of cost and possible plant closure. A key element to this discussion was how much money the Anaconda Company was making. “Experience with other industrial pollution sources including aluminum companies compels the conclusion that plant closure is dictated by corporate economics, not by pollution control,” the Final EIS said. “In support of this belief, Anaconda’s 1973 annual report states: ‘The (aluminum) division achieved record sales during 1973 but operated at a loss due to the power shortage in the Pacific Northwest, alumina production problems in Jamaica and prices that were held below free market levels by government control.’ The Anaconda Company did not shut down the Aluminum Division.” The state also noted that its decision to reject the company’s request for a variance reflected the public interest as expressed in public comments during the Draft EIS review process. [40]

The economic impacts of the AAC smelter were often cited by company supporters who feared environmental regulations might force the plant to close. Local economic information became available in April 1974 with a 31-page report prepared by Norman J. Larson, an economist working for the U.S. Department of Housing and Urban Development. The report was published by the Montana Department of Intergovernmental Relations, Research and Information Systems. According to the report, the AAC smelter was the second largest manufacturing plant in Montana in 1973, after the copper smelter in Anaconda. The aluminum plant directly employed 849

people, and another 1,650 Flathead County residents indirectly depended upon the plant for work. The plant paid out $12 million directly in wages and salaries and was accountable for $32.7 million in total income within the county. In total, the plant accounted for 30.4% of the county's income. Wages at the aluminum plant were among the highest in the manufacturing sector statewide. In 1971, the average wage in the plant was $9,137 per year, which was 43.7% higher than the average wage for all Montana industries and 15.2% higher than the average wage for all primary metals manufacturing in Montana. By 1974, the average wage at the plant had increased to more than $11,000. Since the plant began operating in 1955, it had expanded both employment and earnings and had helped to balance the local economy, which had been heavily dependent on timber alone. The wood products industry accounted for 52.7% of manufacturing earnings in Flathead County, and the aluminum plant accounted for 33.4%. From 1967 through 1971, employment in the wood products industry in Flathead County grew by 2.9%, while employment at the aluminum plant grew by 30.7%. [41]

The Columbia Falls smelter's economic impacts also were reviewed by MHDES staff in the Final EIS. In 1974, the AAC plant employed 911 residents of the Flathead Valley with a total payroll of $9.5 million per year. The impact of this income on the local economy was increased by the multiplier effect by a factor of 7 to 10 times. The company also paid ad valorem taxes of $1.38 million per year for its facility, which amounted to 14.3% of Flathead County's tax revenue. [42] MHDES staff also were interested in the Anaconda Company's financial status. They noted, however, that financial information "has not been made available and is retained as confidential by AAC." Using public information, MDHES estimated that sales by the AAC division of the Anaconda Company had grown from 16.3% in 1971 to 20.5% in 1973, or from $184 million to $276 million. Gross revenues for the Anaconda Company had grown from $946 million in 1971 to $1.343 billion in 1973. Anaconda Company expenditures for additions to plants or new equipment reached a high of $122 million in 1972 and then declined to $79 million in 1973. The Anaconda Company's retained earnings had grown from $284 million in 1971 to $491 million in 1973. [43]

"The tables point out that after a couple of bad years, the corporation is now doing quite well," MDHES staff concluded in the Final EIS. Earnings per share had increased from $2 per share in 1972 to $3.16, long-term debt was at its lowest level in six years, and revenues were approaching 1969 levels. Citing Forbes magazine's look at the nonferrous industry, MDHES staff noted that, "The Anaconda Company did not fare well by 'yardsticks' of 5-year average performances – not surprising considering the uncompensated 17% reduction of their assets (that is the Chilean copper mine)." MDHES concluded that, "In general, recent history indicates that while the Anaconda

Company had a couple of bad years largely because of Chilean government action, it is recovering well. According to the industry and financial analysts, profits and earnings were lower than expected for several reasons, the largest of which was wage and price controls (under President Nixon)." Once price controls were lifted by the Cost of Living Council, the price of ingot aluminum increased from 29 cents per pound in March 20, 1974, to 31.5 cents in April 29, 1974. And according to the Engineering and Mining Journal, the market outlook for 1974 was good. MHDES staff noted that other financial analysts had seen significant impacts on the metal industry by the recent energy crisis. Forbes had concluded that Alcoa, Reynolds and Kaiser were moderately profitable in 1972 but solidly in the black by 1974, and the copper industry was likewise posting profits. [44]

MDHES staff also looked at the impacts of the loss of AAC tax revenue on the state and local governments. "The most severe and probably the most obvious adverse consequences of closing the plant would be the economic impact on the immediate area," the Final EIS said. "Loss of payroll, tax payments, increases in unemployment and welfare, and decline in the auxiliary services required would be expected." These effects would occur mostly at the local level, not to the state as a whole, and the loss of aluminum on the national or global market would not be significant, MDHES staff said. Because AAC's contribution to the total state revenues was not as great as in Flathead County, "the magnitude of the adverse effects would be significantly mitigated," the Final EIS said. MDHES also doubted the Anaconda Company would go so far as to shut down the aluminum smelter in Columbia Falls. "Plant closure in the department's opinion is a remote possibility," the Final EIS said. [45]

The search for a solution

In their variance petition, AAC said its personnel had traveled to aluminum smelting plants in the U.S., Canada and Europe to find a pollution control system that would work with the vertical-stud Soderberg reduction pots used at the Columbia Falls smelter, but nothing was found that would work to control secondary emissions from the potrooms' rooftop clamshell vents. MHDES staff responded in the Final EIS with their own review of aluminum plants. The Harvey Aluminum plant at The Dalles, Ore., had similar Pechiney reduction pots to those used by AAC. Pollution control equipment at The Dalles began as wooden scrubber towers that were modified three times over the past 10 years. The latest primary control system used at The Dalles utilized bubbler chambers. That was followed by wet electrostatic precipitators. [46]

MDHES also described three types of dry scrubbers used for primary emissions control in the aluminum reduction industry – fluidized bed, coated filter and injected alumina. All three took advantage of the tendency of alumina to "absorb" hydrogen fluoride from

pot gases. Once “scrubbed out,” the particulate matter in the gas stream would be captured by baghouses. An example of the fluidized bed was the Alcoa Method 398 dry scrubber, where hot pot gases were treated in a fluidized-bed reactor. An example of the coated filter process was the Alcoa Method 173 or Wheelabrator, where bag filters were coated with alumina. An example of the injected alumina method was a system developed by Alcan, where ore grade alumina was injected into the pot gas stream and then intercepted by baghouses. The recovered alumina in all three systems was fed into the smelting pots, thereby returning fluoride to the reduction process rather than allowing it to escape into the atmosphere. The Alcoa Method 398 process was considered 99% to 99.9% efficient for gaseous fluorides and 98% efficient for particulates captured by the system’s baghouses. The coated filter process was 98% efficient for gaseous fluoride and 99% for particulates. The injected alumina process was 98% efficient for all pollutants. At several plants in Italy, the Montecatini Edison Co. used a system similar to that used at The Dalles, but the wet electrostatic precipitator was placed ahead of the scrubber or gas removal equipment. This allowed dry materials to be captured and reused in the smelting pots. At another plant, bubblers were used instead of wet scrubbers. In Sweden, SAKO’s Sundsvall aluminum plant used a floating bed of plastic balls in the primary system scrubber. The packed-bed scrubber was a cylindrical tower holding about 15,000 inch-and-a-half diameter plastic balls. Water was sprayed into the tower. The system was capable of 97.5% efficiency for gaseous fluorides and 78% for solids. [47]

MDHES also described pollution control equipment used for secondary control – gases that escaped from the reduction pots and exited through the roofs of the potrooms. Large volumes of air typically were allowed into the potrooms for dilution and to lower room temperatures. A spray chamber used at The Dalles included rooftop units and large fans to draw the potroom gases up into the scrubbers. Efficiencies were 88% for gaseous fluoride, 42% for particulate fluoride and 77% for total particulate. Pechiney’s vertical-stud Soderberg plant at Noguerres, France, used tubular atomizers mounted on the roof and a caustic solution. The Intalco plant at Ferndale, Wash., used a similar process and achieved 80% to 85% efficiencies in fluoride removal. The SAKO plant in Sweden used similar towers but mounted them on the ground rather than the rooftop. The Montecatini Edison plant used a rooftop unit but located it at one end of the potroom. A ground-supported system was in use at the Mosjoen Aluminiumwerk plant in Norway. [48]

MDHES also looked at costs for such pollution control equipment, noting that data was sparse and not detailed. AAC told MDHES that pollution control to date had cost the company $33.11 per ton of aluminum produced for capital costs and $5.55 per ton for operating costs. Using tax data from Oregon, MDHES estimated that a rooftop

secondary control system similar to that at The Dalles would cost AAC about $58.80 per ton in capital costs to install. Capital costs for building a water treatment plant, so waste water from the rooftop units wouldn't pollute nearby streams, could cost $130 per gallon per minute, based on the smelter's total capacity. The capital cost of the primary and secondary systems at Pechiney's Nogueres, France plant were about $41 per ton of aluminum produced. The capital costs for AAC's proposal, a foam scrubber, would be much higher – about $80.70 per ton of aluminum, and that did not include wastewater treatment. The Mosjoen Aluminiumwerk plant in Norway replaced its pollution control equipment in 1970 at a capital cost of about $43.50 per ton of aluminum produced, MDHES staff noted. [49]

The public's reaction to AAC's variance request began before it was officially filed on June 30, 1973. The Northern Rocky Mountain Section of the Society of American Foresters published a letter of resolution on June 6 expressing concern over significant damage to vegetation by fluoride emissions by the aluminum plant. The letter was sent to Montana's Congressional delegation, the Montana Board of Health, the EPA, the Flathead National Forest and Glacier National Park. Members of the society were employed in industry and by government. The resolution referred to various government studies conducted in 1970 that showed evidence of fluoride damage to vegetation, and it supported the state's new fluoride emissions standard, which would limit the AAC plant to 864 pounds per day at full capacity. The resolution also called for additional studies and professional legal support for government agencies that might need to sue the plant. [50] Following the filing of AAC's variance petition, a fact-gathering meeting was held at the Missoula County Courthouse on Aug. 17 to discuss statewide environmental concerns, including fluoride emissions by the AAC smelter. The meeting was arranged by Rep. John Melcher, who was under attack by environmentalists for supporting the Alaska pipeline. [51]

On Aug. 31, 1973, a letter to the editor by Jack Holterman criticizing air pollution by the AAC smelter was published in the Hungry Horse News. Holterman pointed out that the company was not even close to achieving compliance levels for fluoride emissions and was also in violation of regulations governing particulate matter and opacity of emissions. "If you or I, Mr. Editor, set a forest fire that caused half the damage attributed by Forest Service publications to the Anaconda plant, we'd be in jail," he said. "So it's time to ask a few questions. Maybe Justice in these parts is not blind after all – just cross-eyed." [52] As AAC worked on the smelter's pollution control equipment, the fluoride problem became a topic in wider forms of media. A popular guide book for hiking in Glacier Park written by Warren L. Hanna and published in 1976 contained two long paragraphs describing damage to the Park by fluoride pollution from the AAC plant in Columbia Falls. Hanna cited an article in the Hungry Horse News as his source. [53]

Misinformation about the air pollution was also common. On June 28, 1979, the Hungry Horse News published a letter by Dr. Bruce McIntyre of the Flathead City-County Health Department in which he corrected a statement by a former nurse at the county health department who had linked pollution by the aluminum plant to tuberculosis. The nurse's statement had been published earlier by both the Hungry Horse News and the Whitefish Pilot. McIntyre pointed out that tuberculosis was caused by bacteria which spread upon contact between humans. No scientific evidence existed that linked tuberculosis to air pollution by the aluminum plant, McIntyre said. [54]

Congress hears AAC complaint

The House Subcommittee on Public Lands of the Committee on Interior and Insular Affairs took testimony on AAC's air pollution problem on Sept. 20 and 21, 1973. Representatives from the Forest Service, National Park Service and the Interior Department's solicitor's office testified on the first day. Rep. Melcher chaired the subcommittee. "It's not a simple matter," Melcher said to introduce the hearing. "It's perhaps one where there is not a simple solution." Thomas C. Nelson, deputy chief for the National Forest System, recapped the history of the fluoride emissions from 1957 to 1968, by which time the smelter had finished expanding to five potlines. Numerous Forest Service studies had been conducted to find out what had caused the dead and dying trees on the east side of Teakettle Mountain and to look at the possibility that fluoride damage led to an insect infestation, Nelson said. Melcher asked Nelson if visible damage around the AAC plant was caused by fluoride emissions. "There is no question in my mind that this is the cause of the damage, nor in the minds of other people doing this work," Nelson replied. Melcher asked Nelson if he would recommend taking legal action against AAC. Nelson said that should be decided by the Justice Department, with the Forest Service providing information and not direction. Melcher noted that some people in the Forest Service were very outspoken in favor of a lawsuit against AAC. [55]

Rep. James Jones of Oklahoma asked Nelson if the Forest Service's concerns and investigations had been brought to AAC's attention. Nelson said numerous newspaper stories had carried the story, and the state of Montana was developing new air quality standards with AAC. Nelson also noted that AAC had reduced fluoride emissions from 8,700 pounds per day to 2,500 pounds. He suggested that the matter of controlling fluoride emissions be handled by the Environmental Protection Agency, not the Forest Service. Jones suggested Nelson work with other federal agencies and AAC "and see if reasonable men cannot reason things out together and get things solved." Melcher, who had worked as a veterinarian, recalled a story about a rancher near Butte where fluoride accumulation in the forage had caused the cattle's new teeth to grow incorrectly. "The cattle, the cows became gummers at a very early age," he said.

Melcher later noted that the cause of the fluoride was the Victor Chemical Co., which he said had paid the rancher for the difference resulting from the damaged cattle. Rep. John Dellenback of Oregon asked Nelson about damage to trees around the AAC plant. Nelson said many of the trees in the damaged area were thin pole trees about seven inches in diameter at breast height. "Many of these trees have been killed, an actual killing of the vegetation," Nelson said. He also noted there had been a diminution in the growth rate of the trees – about one-sixth of the rate in some cases. [56]

Rep. Don Young of Alaska asked Nelson about the investigative process. "Do you truly believe that all the agencies approach this problem with an open mind and not with set results after this study has been made?" he asked. Nelson said he could only speak for the Forest Service, which sought to determine whether or not fluoride had damaged vegetation. Young asked if the Forest Service had considered other factors that could slow growth rates, such as rainfall. Nelson said rainfall was not studied, but the studies included control plots that were established far from the fluoride impacted area. Young then asked for the number of trees killed by fluoride. Clinton Carlson, a Forest Service plant pathologist answered, "It is a very large number." When asked for more details, Carlson could not provide an actual figure. Young asked about the number of trees that would eventually recover, given that conifers replace their needles every two to three years, but Nelson could not quantify that figure. When Melcher asked if, other than state law, federal law existed to prohibit fluoride emissions, Nelson said he didn't know of any such federal laws. [57]

Melcher noted that, to his knowledge, the EPA did not have any fluoride emission standards and Nelson agreed. "Does it not strike you as odd that there is not some basic law that protects the property of the forests, when it is established that there is damage?" Melcher asked. "It would seem that there should be a protection," Nelson replied, referring to federal land. The Forest Service counsel at the hearing explained that the EPA had not gotten around to publishing and promulgating regulations for fluoride emissions – the EPA had the authority to do so but had not implemented the regulations. Melcher asked Nelson why the Agriculture Department's solicitor's office had not shown interest in the matter of AAC fluoride emissions harming trees on public land. Nelson said they were interested in the matter but were waiting for economic data. Melcher noted that AAC had bought a Christmas tree farm in Columbia Falls that had been damaged by fluorides, and he expressed disappointment that the Forest Service did not go after AAC in a similar way. "We would be pounding the door of some attorney, saying, we cannot stand this loss, they are at fault, and we are going to collect from them and get it done," Melcher said. He asked Nelson to provide the subcommittee with information on the "solicitor's feelings and judgment on this matter. I think it has been going on for long enough." When asked for tourist numbers, Glacier

Park Superintendent William Briggle told the subcommittee more than 1.3 million people visited Glacier Park in 1972. [58]

Next to testify was Stanley W. Hulett, the National Park Service's associate director of legislation. Hulett began by noting that the Park Service's top duty was to protect the natural resources of national parks, "to faithfully preserve the parks for posterity in essentially their natural state." Hulett said Glacier Park staff had asked for assistance from the National Air Pollution Control Administration after fluoride impacts became more pronounced in 1969. Hulett noted that "unnatural accumulations are continuing following recently reduced emissions associated with the installation of abatement equipment." Hulett explained that fluoride accumulated even at low emission levels and entered the food chain. He said he spoke to the Interior Department's solicitor's office about the matter, but with no EPA standards for fluoride emissions, it was difficult to commence a federal action as AAC was not in violation of a federal law. Richard L. Ditlevson, an attorney advisor from the Interior Department's Office of the Solicitor, said his office had started collecting information on the matter. [59]

Melcher asked Ditlevson what could be done legally to stop the fluoride emissions. If no federal law was broken, then the government could sue under common law, which was state law, Ditlevson said, but there were problems with that approach: 1) the government needed to define the damages in monetary terms; and 2) Montana had established a Clean Air Act in 1967, and if AAC complied with the act, then it was protected. Ditlevson said he believed the best approach was for the Interior Department and the Agriculture Department to actively participate in the state hearings on an air pollution variance requested by AAC. Ditlevson noted that past fluoride emission lawsuits against aluminum plants in other locations were based on common law, and the monetary damages would be the basis of a common law action. Briggle noted that during a recent interagency meeting in Kalispell, there was a consensus to gather information for an action against AAC and provide the information to the Justice Department. As for Glacier Park, Briggle said, abundant information had been gathered so far, other than impacts on fish. Melcher noted that the Forest Service had said it would be ready for legal action by January 1974, and Briggle said Glacier Park could be ready by then, too. [60]

When asked by Dellenback to quantify the damage by fluoride emissions, Hulett referred back to what he had said about fluoride accumulating in plants and animals. "It is an insidious thing, as we find out with this type of pollution," he replied. Some trees might die 10 years from now, Hulett said. Briggle said visible damage was noticed in the southwest corner of Glacier Park in 1969 to 1970, primarily in lodgepole and ponderosa pine areas where needles had turned brown. He said about 2,000 acres in Glacier Park

were “hot spots, or heavily contaminated areas” where fluoride was accumulating above the state’s standard for vegetation of 35 ppm. “Now, there are no trees lying down on the ground dead as the result of fluoride,” Briggle said. “The damage is continuing to take place.” He also noted that weakened trees might be susceptible to insect attack. Dellenback asked if the damage was reversible once the fluoride emissions were reduced. Theodore W. Sudia, the acting director of the National Park Service’s Office of Natural Science, replied yes – if the emissions ceased, then the effects would gradually diminish, and the fluoride would over time end up in soil and be tightly bound to minerals in the soil. Dellenback asked if there was anything else that could have caused the damage to vegetation other than fluorides. Briggle said no, and Sudia noted that some kinds of damage were specifically attributable to fluorides. “We would have a concern even if there were no visible damage,” Sudia said. The Park Service was concerned about protecting natural ecosystems, Sudia said, where native insects attacking native trees was OK, but not outside influences caused by man. [61]

Anaconda testifies

The next day, Sept. 21, 1973, the House Subcommittee heard testimony from the Anaconda Aluminum Co., its contractors and the Environmental Protection Agency. AAC officials admitted that the plant did not conform with Montana fluoride emission standards that limited the plant to only 864 pounds per day effective June 30, 1973. The subcommittee was most concerned about how fluoride emissions could be damaging vegetation in Glacier Park. [62] Leonard Weinstein, the program director for the Boyce Thompson Institute for Plant Research, which was hired by AAC to study fluoride impacts, told the subcommittee that he had a Ph.D. in plant physiology and was the author of 20-some articles on fluoride effects on plants. He said he had made several annual trips to the AAC plant in Columbia Falls during the growing season in 1970 through 1973. He testified that plant injury in Glacier Park in 1973 was confined to a few needles on several larch and Douglas fir trees near the Apgar Ranger Station, along with some injury to some Oregon grape leaves and goat leaves in a few areas. “In my opinion, this injury is associated with periods of cold and drying winds, which occur during the winter,” Weinstein said. He also compared the results of a fluoride study by the Wisconsin Alumni Research Foundation with the results of a 1972 fluoride study by Clinton Carlson. “These comparative results show clearly that the analytical methods for fluorides in (the 1972) study were inaccurate,” Weinstein said. He noted that WARF would find 10 ppm in a sample and the Forest Service would find 15 to 70 ppm. Weinstein claimed the Forest Service’s methodology would produce high results for all fluoride samples. [63]

George F. Edmunds, an entomologist with the University of Utah's Department of Biology, also under contract with AAC, said he agreed with Weinstein about the Forest Service methodology. "Insects were responsible for much of the damage in the Columbia Falls area, in my visit on the back side of Teakettle Mountain and extending to near Coram, Hungry Horse and in Glacier National Park," Edmunds said. "In Columbia Falls and Aluminum City, there was considerable damage to conifers by mites and pine needle scale. In 1970, lodgepole pine was lightly to severely damaged by tortrix budworm in a large area on the back side of Teakettle Mountain and ranging to Coram, Hungry Horse and to the southern tip of Glacier National Park. There was also damage by needle miners, needle sheath miners and some pine needle scale." Edmunds continued to describe insect damage on land east of the AAC plant. "On the back side of Teakettle Mountain, there is an area where the insects have killed or damaged a substantial number of lodgepole pine," he said. "There is no reasonable evidence that indicates that fluoride concentrations has any causal relationship with the insect populations." Edmunds also criticized at length the findings of an October 1971 Forest Service report by Clinton Carlson and Jerald Dewey titled "Environmental Pollution by Fluorides in Flathead National Forest and Glacier National Park." Edmunds questioned if the document was peer reviewed. [64]

Warren Hook, the former environmental manager at the Columbia Falls plant who had become an environmental consultant for AAC in Louisville, Ky., also testified at the hearing. Hook described the vertical-stud Soderberg reduction technology used at the Columbia Falls aluminum plant, improvements that had been made over the years to reduction cells, and to duct work, wider anodes, use of venturi scrubbers, use of pitch with a higher melting temperature, use of Kaiser Fluid coke, changing the pin-pulling schedule and studies of rooftop scrubbers. As for the state's 864 pound per day fluoride emission standard, Hook said, "The standard is not achievable by any existing vertical-stud plants, even with secondary scrubbers." Hook noted that AAC was installing a pilot rooftop scrubber for test purposes. [65] The new Swedish air pollution control process used foam to recover fluoride emissions at the roofs of potrooms. According to Hook, a three to five yearlong study of the foam process would be a first step in finding a technically proven and economically sound method of pollution control for the AAC smelter. [66]

AAC President Joseph B. Woodlief testified on economic considerations. The Anaconda Company in 1955 had installed "the best primary fluoride control system then available," but expansion of the plant to five potlines by 1968 had "resulted in emission levels beyond what we had projected earlier. This caused evident damage to vegetation." Woodlief said venturi scrubbers had improved primary scrubbing efficiency from 93% to more than 98%, but following an investigation of rooftop scrubbers for

secondary control, AAC "has not found any feasible existing control that would make a substantial contribution toward eliminating roof fluoride source." Converting the plant to prebake reduction pots "is completely unfeasible," Woodlief said – the $80 million cost could not be supported "because rapidly rising rail, power and gas costs in the Columbia Falls location, remote as it is from both the alumina source and markets, would not justify such an expenditure." Woodlief said AAC was experimenting with pollution control technologies and had hired scientists to study fluoride impacts in Glacier Park. The AAC scientists "each time have concluded that the Park is not suffering damage of any sort." All the fluoride content readings have been below threshold levels at which damage might be expected to occur, Woodlief said. He noted that Anaconda Company shareholders had $67 million invested in the Columbia Falls aluminum plant and $31 million invested in fabricating facilities in the U.S. that were supplied by the Columbia Falls plant. Local taxes paid by the Columbia Falls plant came to $1.3 million per year, which was about 14% of the total for Flathead County. The local payroll was $9.5 million, but the combined payroll including out-of-state fabricating plants came to $20.5 million. Woodlief noted that AAC had spent $13 million on air pollution control equipment since 1968. [67]

When Melcher asked if the state fluoride emission limit of 864 pounds per day was sufficient to protect vegetation and wildlife, Weinstein said the answer depended on a number of factors, including meteorology, topographic features, the rate of dilution and rainfall, so he could not come up with an answer. Melcher compared the previous day's testimony with the current testimony and noted that the subcommittee could not be sure if no further damage would occur at current emission levels. Edmunds replied that on the east side of Teakettle Mountain, "the insect damage far exceeds any fluoride damage." He added, "If one stands and looks across the Lake McDonald, and see the great browning across the ridges there, these are insect problems, exclusively, and having nothing to do with fluoride emissions." Edmunds repeated his criticism of the Carlson-Dewey report, saying it selectively used data and came up with a different interpretation of the same literature that Edmunds had read and cited in his own work. Edmunds said he was willing to work with the Forest Service scientists to generate new reports. Weinstein agreed with Edmunds about the Forest Service report. He noted that elevated fluoride levels could be found in Glacier Park above background levels, but the Forest Service did not use approved methodology for analyzing fluoride content – the Carlson-Dewey study results were not accurate, and fluoride levels were exaggerated by the analytical method used, he said. Weinstein also criticized the isopol map created by Carlson to show where trees damaged by fluoride were located. Weinstein said he sent the same Forest Service data to a company in Cambridge, Mass., which plotted a completely different map. Weinstein said the isopols in the Forest Service report "were drawn to fit what the authors felt was the best line." [68]

Representatives from the Environmental Protection Agency followed AAC and its environmental contractors. James Lehr, the deputy director for Air and Air-Water Programs at EPA's Region 8 Office, testified to the subcommittee that the EPA and the state of Montana were jointly responsible for overseeing compliance with particulate standards, but the EPA did not have fluoride emission standards. Lehr said the EPA supported Montana's compliance schedule for the AAC plant in Columbia Falls. "We think the technology is available and that the job can be done," Lehr said. Montana had two fluoride standards – one limiting the fluoride level in forage to 35 ppm, and another limiting the total amount of fluoride that could be emitted by the aluminum plant to 864 pounds per day. Lehr said the AAC smelter in Columbia Falls was currently in violation of both particulate and fluoride emissions, so it needed a variance from the state of Montana. Kirk Foster, a technical support staff member for the EPA's Stationary Source Enforcement Division, said the Forest Service had estimated damage to its forests by measuring the fluoride levels in the vegetation and then assuming that areas with elevated levels were damaged. Foster said he didn't think the scientists from AAC, the University of Montana or the Forest Service could completely quantify the damage. [69]

Foster suggested that, from a technical and not a legal viewpoint, particulate and fluoride emission levels were associated but were being regulated separately, and he believed that control of particulates would help control fluoride emissions. Reid Iversen, a control engineer from the EPA's Office of Air Quality Planning, followed up on Lehr's belief that AAC could comply with the state's fluoride emission standard. Iversen referred to work at the aluminum smelter at The Dalles, which installed rooftop scrubbers to control secondary emissions; an aluminum smelter in Europe that had attained low fluoride emissions; and the 1971 Singmaster & Breyer report completed for the EPA, which looked at potential fluoride control technologies. Iversen noted that five aluminum plants in the U.S. used vertical-stud Soderberg reduction cells, but the smelter at The Dalles was the only one with a secondary control system. Problems with rooftop wet scrubbers included freezing, which Iversen said he didn't know how to prevent, and wastewater discharge, which he believed could be treated to meet state standards. [70]

Moving toward a solution

While the variance provided AAC with time to investigate pollution control systems to reduce total fluoride emissions for its Columbia Falls smelter, the company faced an unexpected problem when it came to restarting reduction pots idled because of power supply problems. Emissions at the smelter tended to increase during the time when new pots were cut in or old pots were restarted. On Jan. 2, 1974, smelter crews began warming up reduction pots in Potroom 3 that had been idled since the Bonneville Power

Administration curtailed power in April 1973. As the work proceeded, the company received a letter from Jon Bolstad, an environmental engineer at MDHES, stating that AAC would need an air pollution permit to reactivate a potline that had been out of service for more than 180 days. [71] Other kinds of potline issues were raised while the smelter operated under the variance. During July, August and early September 1974, a number of problems occurred with the reduction pots at the smelter. According to General Manager E.O. Woster, the pots were not working efficiently as a result of shattered anodes, increased pot temperatures, poor current distribution and shrinking metal output. As a result, the plant was producing less metal and more pollution, while the state's new fluoride emission standard was based on a formula linking fluoride emission to aluminum production. In addition, the plant often had difficulties running the pots in hot weather. To address the problem, the company had reduced power, canceled vacations for supervisors and hired an additional 25 to 30 workers. [72]

A proposed air pollution compliance schedule for the AAC smelter in Columbia Falls was filed on July 31, 1974, pursuant to the Montana Administrative Procedure Act, the Montana Clean Air Act and the State Implementation Plan as required under federal law. The "Stipulation of Proposed Compliance Schedule for Variance" was signed by MHDES Director John S. Anderson and Krest Cyr, vice president and chief counsel for the Anaconda Company, and was scheduled for a hearing in federal court in Helena on Aug. 12 and Sept. 5. According to the document, the state and the company had investigated both future and available technology for the control of fluoride emissions. If the agreement was approved, then within 60 days the company would submit a conceptual control plan for fluoride emissions. Once that plan was accepted by the state, the company had 120 days to complete engineering plans for a new pollution control system for one potroom, along with preliminary plans for the remaining nine potrooms. The plans for the remaining nine potrooms had to be completed by Nov. 1, 1976. Within 120 days of the completion of the engineering plans, the company was required to sign contracts and begin purchasing equipment for the first potroom. Equipment for the other nine potrooms needed to be ordered within six months of the completion of those plans. The company then had 700 days to complete construction and another 700 days to test the operation of the new control equipment. After that, the state and the company had 360 days to review the effectiveness of the new equipment. The company was to proceed with due diligence and complete the schedule at least 90 days prior to the sum of all the days in the schedule. If the company proposed to expand the aluminum plant's capacity in the future, the proposed compliance schedule would not apply to the expansion. [73] Portions of the six-page agreement were published in the Hungry Horse News on Aug. 2, 1974. [74]

The proposed compliance schedule was presented at a hearing before the Montana Board of Health on Aug. 12, 1974. Benjamin Wake explained that the state had granted the air pollution variance requested by AAC after the company described a promising new technology to control fluoride emissions. Charles E. Taylor, the plant's assistant manager, told the health board that a new piece of pollution control equipment called a Foamator would collect and treat fluorides before they left the potroom rooftops. Taylor said the plant's existing wet scrubber systems were removing 98.5% to 99% of the fluoride gas and particulate matter from the pot gases. Taylor noted that Montana's fluoride emissions regulations were more stringent than the federal government's. "We know of no technology that will meet the Montana fluoride emission standards at Columbia Falls," Taylor said, while acknowledging that the state had agreed to allow the company to try to control emissions with the new Foamator system. Taylor said he expected the Foamator system to be completely in place by mid-1979. AAC President Joseph Woodlief testified that fluoride scrubbers had been installed at the plant in Columbia Falls since it began operation in 1955 and that the company had spent $13 million since 1955 on improvements to the plant's air pollution control systems. Two days later, John Bartlett, chairman of the Montana Board of Health, said he expected a decision would be made by late September 1974 about a compliance schedule. He said he liked the requirement that AAC make regular progress reports on their compliance progress. [75]

A hearing to determine whether another air pollution variance should be granted to the AAC plant in Columbia Falls was held by the Montana Board of Health and MDHES in Kalispell on Sept. 5, 1974. Clinton Carlson testified about damage to timber on federal, state and private lands caused by fluoride emissions from the smelter since 1957 and especially since the plant was expanded in 1965 and 1968. [76] Carlson said he had found the spread of fluoride damage as trees were weakened and then became susceptible to insect infestations. He also described the movement of fluorides upwards through the food chain. AAC representatives were questioned about the possibility that the company could capture 85% of the fluoride and 70% of the particulates emitted by the plant. Charles Taylor, Charles E. Fisher and A. Warren Hook all agreed that the company could achieve that level of pollution control. Glacier Park Superintendent Phillip R. Iversen urged that no variance from the present Montana standards be granted and argued that additional fluoride emissions reduction was needed if the existing state standards were not adequate. Iversen referred to numerous fluoride investigations by the EPA, Forest Service and Clancy Gordon, a botanist at the University of Montana, and noted that federal law provided that the Park must remain "unimpaired" and that fluoride emissions were damaging vegetation in the Park. [77]

When asked for his opinion about the proposed compliance schedule, Iversen told the health board that implementing satisfactory pollution controls at the plant would take a long time, and the National Park Service view was that the pollution must stop now. Robert Rothweiler, representing the Montana Department of Fish and Game office in Missoula, testified that his agency had not conducted any fluoride investigations and relied on the work of the Forest Service and Gordon. He expressed concern that fluoride emissions could damage vegetation that provided food for big game. I.J. Hindawi, from the EPA office in Corvallis, Ore., said he had conducted research on Teakettle Mountain, which overlooked the AAC plant; the Columbia Falls yard of Loren Kreck, who had sued AAC for air pollution damage; property adjacent to the AAC plant which was owned by the Dehlboms, who had also sued AAC for air pollution damage; and a city park in Columbia Falls. Hindawi testified that he had found fluoride very definitely in excess of the acceptable level of 10 ppm and found damage to vegetation as a consequence of fluoride emissions from the aluminum plant. [78]

The Hungry Horse News called the proposed compliance schedule a positive step in a Sept. 13, 1974, editorial. The editorial called for significantly reducing air pollution while keeping the work force employed and suggested an enforceable agreement was the best solution. [79] The Montana Board of Health accepted the compliance schedule during a Sept. 27 hearing. AAC was given nearly five years to bring its fluoride emissions and other air pollution within state guidelines. MDHES environmental engineer Jon Bolstad said the outside date for compliance was July 1, 1979, by which time the AAC plant was required to reduce its fluoride emissions by 54% below existing levels and reduce particulates by 27% to 45% below existing levels. Bolstad told the board the compliance schedule was “a negotiated scheme we don’t like and they don’t like.” The AAC plant was emitting 1,800 to 2,000 pounds of fluoride per day at full production, while the state standard was 864 pounds per day. About 260 pounds per day escaped the primary control system, which treated collected pot gases, and another 1,500 pounds per day vented through the potrooms’ clamshell roofs. According to Bolstad, the smelter had emitted from 10,000 to 12,000 pounds of particulates per day before the plant installed new pollution control equipment. [80]

In 1975, the Montana Department of Health and Environmental Sciences’ Air Quality Bureau published a summary data report from around the state. “A special study was continued in the Kalispell-Columbia Falls area by DHES,” the report said. “This study is oriented mainly toward point-source type pollution sources. The aluminum plant and several wood products plants are the major industrial emission sources in the Flathead Valley. The greatest concentration of sources is located in and around the town of Columbia Falls. Within a 3-mile radius are located the aluminum plant, a plywood plant, a fiberboard plant and four sawmills. Within four miles of Kalispell, one finds a plywood

plant and three sawmills." The department reported that particulate levels were in excess of both federal and state ambient standards at several locations. Sampling stations at Columbia Falls High School and the Downard residence in Kalispell recorded the highest 24-hour particulate levels. Fluoride sampling using calcium formate papers resulted in maximum one-month readings at a site on Teakettle Mountain and the highest annual average fluoride concentration at another site on Teakettle Mountain. "Anaconda Aluminum is the only source in this area currently on a compliance schedule," the report said. "This schedule provides for compliance by June of 1979 and should reduce fluoride emissions by about 65% and particulate emissions by about 45%." [81]

According to the department's data, AAC emitted an average of 1,560 tons of particulate per year and 456 tons of fluoride gas per year. By contrast, the Superior Building Co. mill in Columbia Falls, the largest source of particulate among the area's timber mills by far, emitted 219 tons of particulate per year, while unpaved roads in the Kalispell-Columbia Falls area accounted for 66,550 tons of particulate per year and slash burning in the area accounted for 26,484 tons of particulate per year. According to sampling stations data collected over a 30-day period from January through December, ambient fluoride levels violated standards for nine months at the Dehlbom residence near the AAC plant, 10 months at the Feirstein residence several miles east of Columbia Falls, five months at the Bad Rock Canyon station, nine months at the Dehlbom field, 10 months at the AAC station, nine months at five different sites on Teakettle Mountain, nine months at the Aluminum City subdivision near AAC, and 12 months at a trailer set at the base of Teakettle Mountain. Ambient fluoride levels violated standards for three months over 12 months of sampling at one station in Glacier National Park, for one month over six months of sampling at four Park stations and zero months over six months of sampling at five Park stations. [82]

Field studies continue

With the compliance schedule in place, Forest Service scientists continued to investigate damage to trees and vegetation on the Flathead Forest caused by fluoride emissions from the AAC plant. In January 1975, the Forest Service issued a report on the impact of fluoride emissions on lodgepole pines based on a study conducted by Carlson and biologist William P. Hammer. The study was conducted in the summer of 1973 and covered 1,424 acres in 21 stands ranging from north of Half Moon to Bailey Lake in the Whitefish Range, easterly up the Middle Fork canyon to the vicinity of Lake Five, and on both sides of Teakettle Mountain closer to the smelter. The 14-page report described fluoride emissions from the aluminum smelter reducing the growth of lodgepole pines, especially in hand-thinned stands where growth was expected to accelerate. Radial

growth losses ranged from 9% to 22%. The report noted that a severe insect infestation covered much of the same area where the fluoride impacts took place and noted, “The evidence suggest that the pines were predisposed by fluorides to insect attack.” The impacted area was estimated to be 150,000 acres of forest lands surrounding the smelter plant. [83]

Investigations in Glacier Park likewise continued. On July 17, 1975, Gordon issued his report on “Monitoring of Fluoride Accumulation in Glacier National Park.” Included in his report was data from the Columbia Falls area, including property owned by the Dehlboms, Bob Burk, the Sediveys and Loren Kreck from 1971 to 1974. Samples from ground squirrels came from Glacier Park, the Middle Fork canyon and the Dehlboms’ property. [84] A July 3, 1978 report by Glacier Park plant ecologist Robert Hall described “a marked increase” in ambient fluorides in the Park in 1976. The Montana state standard of 0.300 mg of fluoride per square centimeter measured on test paper used in monitoring stations over a 30-day period was never exceeded in 1975, Hall said, but it was surpassed 32 times in 1976. This led to a call for more vegetative sampling in 1977 to assess possible damage to plants in the Park. The Montana standard for ambient fluoride was exceeded 36 times at monitoring stations in 1977, Hall said, which might have resulted from the stations being relocated. Hall said it was possible the levels were decreasing in 1977. He also noted that the Montana standard “has been determined to be unenforceable,” but it was the only standard to cite in a report. [85]

On June 24, 1977, Iverson sent a memo to Neal Guse at the National Park Service’s Natural Resources Management Division in Washington, D.C. providing results from fluoride pollution investigations in Glacier Park. Iverson included Hall’s summary report, which included information on fluoride impacts to rodents. Hall reported that high ambient fluoride levels and resultant uptake of fluoride appeared to have no effect on the fertility or reproduction, sex or age ratios and growth rates of rodents, and there was no evidence of dental fluorosis. “Indications are that fluoride levels in field-trapped mice are not detrimental to their health.” Hall did find evidence that fluoride was accumulating in vegetation in Glacier Park and could be causing “hidden” or “invisible” damage that could lead to physiological or morphological stresses. He concluded that ambient fluoride pollutants continued to enter Glacier Park, but the 30-day levels fell within the accepted Montana air quality standard. He recommended continued monitoring of flora and fauna in Glacier Park. “Since Anaconda is installing new devices to lower the emissions of fluoride, the continued monitoring of fluoride pollutants within Glacier National Park will help in determining the effect of these devices.” [86] In 1977, Glacier Park was designated a Class 1 air quality area and began to receive the highest protection under the federal Clean Air Act. Resources that could be affected by

poor air quality included visibility, high elevation headwater lakes, soils, vegetation and wildlife. [87]

It was well known that fluoride was not the only hazardous chemical emitted by the aluminum smelter in Columbia Falls, but the focus by state regulators and federal scientists had been on fluoride. Gordon, however, warned about sulfur dioxide emissions in a Feb. 7, 1977, letter to Kalispell attorney Jon Heberling that related to the Ove vs. AAC air pollution lawsuit. Gordon said the AAC smelter emitted 2,000 to 3,000 pounds of sulfur dioxide per day – which was about half the amount emitted by the Hoerner-Waldorf paper plant in Missoula. Demonstrating damage to trees in the Columbia Falls area by sulfur dioxide would be difficult, however, because it would be totally masked by the fluoride impacts, he said. "Fluoride emissions are approximately 100 to 1,000 times more toxic than sulfur emissions," he advised Heberling. "Personally, I would leave sulfur out of the picture at this time." [88]

Sulfur dioxide was not the only hazardous chemical emitted by the heating of coal tar pitch and petroleum coke in open-topped Soderberg anodes. A class of chemicals known as polycyclic aromatic hydrocarbons was also emitted, and they escaped along with fluoride as secondary emissions through the potrooms' rooftop clamshell vents. Strong evidence of the geographical extent of these polycyclic aromatic hydrocarbon emissions was reported three decades later in a study by the Western Airborne Contaminants Assessment Project. The National Park Service had teamed up with the EPA, U.S. Geological Survey, Forest Service, Oregon State University and the University of Washington from 2002 to 2007 to conduct an airborne-contaminants study in 20 western national parks, including Glacier Park. The study found polycyclic aromatic hydrocarbon concentrations in snow, lichens and sediment that were 3.6 to 60,000 times greater in Glacier Park's Snyder Lake watershed than in watersheds in the other western and Alaskan national parks. Polycyclic aromatic hydrocarbons were considered markers for incomplete combustion and included a wide variety of chemicals, including acenaphthylene, pyrene and benzo(a)pyrene, the study stated. Some polycyclic aromatic hydrocarbons were considered persistent, bioaccumulative and toxic and were suspected to cause cancer and developmental, reproductive and neurological impairment. "Once deposited to water and land, these compounds build up in organisms and magnify in concentration with each level of the food chain," the project reported. "Several lines of evidence point to smelting operations at the (Columbia Falls Aluminum Co. plant in Columbia Falls), which came on line in 1955, as a major source of PAHs to the Snyder Lake catchment at Glacier National Park." [89]

The Western Airborne Contaminants Assessment Project also collected data from Oldman Lake, in Glacier Park on the opposite side of the Continental Divide from the

aluminum smelter. To differentiate between polycyclic aromatic hydrocarbons that could have originated from the aluminum smelter from polycyclic aromatic hydrocarbons that could originate from forest fires, oil and gas flares from petroleum operations, or from motor vehicles used by the millions of tourists who visited the Park, the project calculated the ratio of indeno(1,2,3-cd)pyrene concentration to indeno(1,2,3-cd)pyrene plus benzo(e)pyrene concentration. A low ratio around 0.4 indicated the polycyclic aromatic hydrocarbons originated from the aluminum smelter, while 0.55 indicated wood combustion and 0.75 indicated gasoline motors. Because lake sediments accumulated over time, the presence of different kinds of polycyclic aromatic hydrocarbon ratios could be dated relative to the depth of the sediments. Key dates were pre-1955, before the smelter began operating, and post-2002, when the smelter reopened after a one-year closure and operated at various levels of capacity. The project reported that a rough estimation of the contribution of polycyclic aromatic hydrocarbons by the aluminum smelter to the 2003-2004 snowpack in the Snyder Lake watershed was about 80%, while wood combustion accounted for about 20%. “PAH concentration in the snowpack at Snyder Lake closely mirrored CFAC operating capacity during the 2002-2003 and 2003-2004 seasons,” the project reported. Furthermore, when the smelter reduced capacity from 60% to 20% from 2003-2007, “The reduction in smelter operations and hence PAH emissions is consistent with a decline in PAH concentrations in the snowpack over this timeframe.” [90]

The Western Airborne Contaminants Assessment Project noted that polycyclic aromatic hydrocarbon concentrations at Snyder Lake varied considerably, but the polycyclic aromatic hydrocarbon ratio measured in the snowpack remained fairly constant from 2003 to 2004 “indicating that the smelter was still the dominant source of PAHs.” The project also sampled polycyclic aromatic hydrocarbons in lichen. “Because PAHs are a combustion byproduct, concentrations typically correlate well with population density,” the project reported. “However, this does not hold true for Glacier National Park, as the relatively modest population surrounding the Park does not account for the high PAH concentration measured in the Snyder Lake and Oldman Lake catchments.” The project also sampled fish in Glacier Park and found that polycyclic aromatic hydrocarbon concentrations were detected in less than 50% of the project’s samples. The project’s report suggested that this resulted from low ambient concentrations and rapid transformations and/or elimination from fish, and that polycyclic aromatic hydrocarbons in the fish likely did not exceed health consumption thresholds. But more fish needed to be sampled in order to state human and wildlife health risks conclusively, the project’s report said. The project referred to past fluoride studies to explain an airborne pathway for polycyclic aromatic hydrocarbons emitted from the smelter to the Park. In 1970, fluoride isolines were mapped along transects from the smelter. The same upslope winds that transported fluoride to the Park could have transported polycyclic aromatic

hydrocarbons from the smelter, the project reported. From 1999 to 2005, the smelter emitted on average about 14 tons of polycyclic aromatic hydrocarbons per year, the report said. [91]

Following the approval of the compliance schedule with the state, the Anaconda Aluminum Co. stuck with its initial plans to use Ducon Venturi equipment to improve its primary emissions control equipment and to use Foamator wet scrubbers to control secondary emissions from the potrooms. But after a year of poor performance, these systems were abandoned in favor of a huge project that called for rebuilding all 600 reduction pots and replacing the wet scrubbers that were installed at the plant in 1955 with new high-tech dry scrubbers. The conversion was expensive and took years to complete, which didn't satisfy the Forest Service or National Park Service. By 1978, as it became clear that AAC was not going to meet the conditions of the compliance schedule, the federal government sued AAC. One month later, the second dry scrubber unit went online, and the plant headed toward relative compliance with the state's fluoride emissions standard, which were increased slightly in 1981. After that, the smelter's biggest troubles were no longer air pollution – it was power costs and markets.

---

[1] "Flathead economics aren't that grim," Hungry Horse News, Feb. 11, 1972 [AL0918]
[2] "Grant AAC variance regarding chlorine," Hungry Horse News, May 25, 1973 [AL1158]
[3] "No development on fluoride variance," Hungry Horse News, June 22, 1973 [AL1161]
[4] "State fluoride rule takes effect June 30," Hungry Horse News, March 16, 1973 [AL1146]
[5] "Environmental Impact Statement for the air pollution variance requested by the Anaconda Aluminum Company for its aluminum reduction plant at Columbia Falls, Montana," Montana Department of Health and Environmental Sciences, May 20, 1974 [AL0439]
[6] "Krest Cyr named AAC V. President," Hungry Horse News, Jan. 7, 1972 [AL0912]
[7] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL0439]
[8] Environmental Impact Statement for the air pollution variance requested by the Anaconda Aluminum Company for its aluminum reduction plant at Columbia Falls, Montana, Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[9] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL0439]
[10] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[11] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[12] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[13] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[14] E.O. Woster, Request for air pollution variance by the Anaconda Aluminum Company, National Archives and Records Administration, Denver, Colo., June 30, 1973 [AL5548]
[15] James Robischon, Supplemental answer by defendants 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., 1979 [AL5555]
[16] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[17] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[18] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL0439]

[19] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[20] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL0439]
[21] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL0439]
[22] For more information, see "A Citizen's Guide to the NEPA: Having your voice heard," U.S. Council on Environmental Quality, December 2007
[23] For more information, see "A citizen's guide to public participation in environmental decision making," Montana Legislature online, 2002
[24] Legal letter from John Lepley to Irwin Dickstein, July 10, 1973 [AL4629]
[25] Lepley, July 10, 1973 [AL4629]
[26] Legal letter from James Robischon, Nov. 21, 1973 [AL4628]
[27] Affidavit of Warren Hook, Anaconda Aluminum Co. environmental officer, for the Anaconda Aluminum Co.'s request for an air pollution variance, Oct. 17, 1973 [AL4627]
[28] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL0439]
[29] "Schedule fluoride hearing in Helena," Hungry Horse News, Feb. 15, 1974 [AL0682]
[30] "Environmental impact statements available," Hungry Horse News, March 1, 1974 [AL0684]
[31] "Commissioners support AAC," Hungry Horse News, Feb. 22, 1974 [AL0683]
[32] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL0439]
[33] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL0439]
[34] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL0439]
[35] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[36] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[37] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[38] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL0439]
[39] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL0439]
[40] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL0439]
[41] "AAC fluoride problem before Board of Health," Hungry Horse News, May 31, 1974 [AL0686]
[42] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL0439]
[43] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[44] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[45] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[46] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[47] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[48] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[49] Montana Department of Health and Environmental Sciences, May 20, 1974 [AL4252]
[50] "Damage from fluoride concerns foresters," Hungry Horse News, June 15, 1973 [AL1160]
[51] "Fluoride hearing in Missoula," Hungry Horse News, Aug. 17, 1973 [AL1165]
[52] Jack Holterman, "AAC fluorides," Hungry Horse News, Aug. 31, 1973 [AL1166]
[53] Warren L. Hanna, "Fluoride invasion," from "Montana's Many-Splendored Glacierland," 1976 [AL0567]
[54] Bruce McIntyre, MD, "Anaconda 'not responsible' – says official," Hungry Horse News, June 28, 1979 [AL0500]
[55] "Report of Proceedings, Hearing held before Subcommittee on Public Lands of the Committee on Interior and Insular Affairs, Fluoride Emissions," U.S. House of Representatives, Sept. 20, 1973 [AL5488]
[56] Subcommittee on Public Lands, Sept. 20, 1973 [AL5488]
[57] Subcommittee on Public Lands, Sept. 20, 1973 [AL5488]
[58] Subcommittee on Public Lands, Sept. 20, 1973 [AL5488]
[59] Subcommittee on Public Lands, Sept. 20, 1973 [AL5488]

[60] Subcommittee on Public Lands, Sept. 20, 1973 [AL5488]
[61] Subcommittee on Public Lands, Sept. 20, 1973 [AL5488]
[62] "Foam process may reduce fluorides," Hungry Horse News, Sept. 28, 1973 [AL1168]
[63] Subcommittee on Public Lands, Sept. 21, 1973 [AL5489]
[64] Subcommittee on Public Lands, Sept. 21, 1973 [AL5489]
[65] Subcommittee on Public Lands, Sept. 21, 1973 [AL5489]
[66] "Foam process may reduce fluorides," Hungry Horse News, Sept. 28, 1973 [AL1168]
[67] Subcommittee on Public Lands, Sept. 21, 1973 [AL5489]
[68] Subcommittee on Public Lands, Sept. 21, 1973 [AL5489]
[69] Subcommittee on Public Lands, Sept. 21, 1973 [AL5489]
[70] Subcommittee on Public Lands, Sept. 21, 1973 [AL5489]
[71] "AAC needs permit to restore output," Hungry Horse News, Jan. 4, 1974 [AL0679]
[72] "AAC production down, pollution increases," Hungry Horse News, Oct. 18, 1974 [AL0696]
[73] John Anderson, Krest Cyr, "AAC-Board of Health proposed agreement," Hungry Horse News, Aug. 9, 1974 [AL0689]
[74] "Pollution subject of public hearings," Hungry Horse News, Aug. 2, 1974 [AL0687]
[75] "Pollution agreement before state board," Hungry Horse News, Aug. 16, 1974 [AL0691]
[76] "Forest Service blasts pollution," Hungry Horse News, Oct. 5, 1978 [AL0461]
[77] "Conclude hearing on AAC pollution compliance," Hungry Horse News, Sept. 6, 1974 [AL0693]
[78] Hungry Horse News, Sept. 6, 1974 [AL0693]
[79] "Cut pollution, keep payroll," Hungry Horse News, Sept. 13, 1974 [AL0694]
[80] "Board accepts AAC pollution agreement" and "Explains AAC compliance," Hungry Horse News, Oct. 4, 1974 [AL0695]
[81] Michael D. Roach and James W. Gelhaus, " Annual Air Quality Data Summary for Montana 1975, The Montana Department of Health and Environmental Sciences, Environmental Sciences Division, Air Quality Bureau," 1975
[82] Roach and Gelhaus, 1975
[83] "Note adverse effect of fluorides on lodgepole," Hungry Horse News, Jan. 10, 1975 [AL1312]
[84] Interrogatories for U.S. v Atlantic Richfield Co. and the Anaconda Company, Civil Action No. 78-80-M, 1978 [AL4635]
[85] Interrogatories, 1978 [AL4635]
[86] Interrogatories, 1978 [AL4635]
[87] "Explore air, Glacier National Park air quality information, Overview," Glacier National Park online, July 16, 2006 [AL3955]
[88] Letter from Clarence Gordon to Jon Heberling, Feb. 7, 1977 [AL4625]
[89] Letter from Andrea Stacy, National Park Service, Air Resources Division, to EPA Docket Coordinator, with comments on placing CFAC site on Superfund NPL, May 26, 2015 [AL5107]
[90] Stacy, May 26, 2015 [AL5107]
[91] Stacy, May 26, 2015 [AL5107]