Chapter 56

Regulations, restarts and ductwork

The Montana environment endured heavy impacts from a century of metal mining before the state's citizens stepped up and began to establish and enforce air and water pollution laws. According to Montana historian Harry Fritz, Montana underwent a triple revolution between 1965 and 1980 – political, economic and ideological. Part of this political revolution involved the creation of a new state constitution in 1972. A referendum calling for a new constitution was passed by 65% of the voters in 1970, and one hundred elected delegates convened in Helena in November 1971 to draw up the new document. "The Montana Constitution of 1972 was an environmentally conscious monument to a modern, urban, self-confident state emerging from the long shadow of the Anaconda Company," Fritz said. The new constitution drew from both national concerns about the environment and local threats to create a mandate for cleaning up existing pollution and preventing further degradation, Fritz said. [1]

Members of the Montana Constitutional Convention adopted the new state constitution on March 22, 1972, and the state's voters ratified the document on June 6. The preamble contained language showing an appreciation by the people for the state's natural beauty: "We the people of Montana grateful to God for the quiet beauty of our state, the grandeur of our mountains, the vastness of our rolling plains, and desiring to improve the quality of life, equality of opportunity and to secure the blessings of liberty for this and future generations do ordain and establish this constitution." This general feeling continued in Article II Section 3, which introduced the inalienable rights of its citizens: "All persons are born free and have certain inalienable rights. They include the right to a clean and healthful environment." Article IX Section 1 also dealt with the environment and natural resources: "The state and each person shall maintain and improve a clean and healthful environment in Montana for present and future generations." The new constitution directed the Montana Legislature to provide for administration and enforcement of these duties. [2]

How and why the state subsequently established and enforced environmental regulations often was settled only after contentious debate, with winners and losers. Business and industry interests typically were concerned that environmental regulations cost money up front for permitting and pollution control equipment and years later by interfering with efficient production or trouble-free maintenance. On Nov. 8, 1994, Montana Chamber of Commerce President Dave Owen warned that environmental regulations would dominate the upcoming sessions of the Montana Legislature. As an example, he pointed to the debate over whether Montana cement companies should be allowed to burn hazardous spent potliner waste from the Columbia Falls Aluminum Co. in their kilns. Owen stressed the need for "eco-sanity." [3] Disputes over environmental regulations often were handled by scientists and engineers before they became too contentious, but they also ended up in court where principles of free-market commerce, property rights, reasonableness and scientific evidence were pitted against the state constitution's provisions. In 1999, the Montana Supreme Court affirmed the state constitutional guarantee of a "clean and healthful environment," a ruling that did not guarantee that the how and why of environmental regulation was settled matter. [4]

Industrial impacts

Over the years, aggregate data about pollution by industry was made available to the public. Often the data were estimates based on self-reported production numbers – for example, if a plant purchased X pounds of a chemical but only Y pounds appeared in the finished product, then X minus Y was the amount of the chemical thought to be released into the environment. Furthermore, based on what was known about how chemicals were stored, transported and processed, reasonable guesses could be made about how the chemicals were released – for example into the air, groundwater or surface water.

According to the Environmental Defense Fund's Scorecard website, CFAC was responsible for about 2.8 million pounds of air releases in 1988. That figure dropped to a range of 215,399 to 353,000 pounds per year from 1989 through 2000 before dropping to 5,440 pounds in 2001 and then rising again to 186,150 pounds in 2002. Water releases were zero for most years from 1988 through 2002, with the exception of 1991 when the figure was 350 pounds and 1992 through 1995 when the figure was 500 pounds per year. Off-site transfers of waste material were zero pounds from 1988 through 1990, then increased to 50,000 pounds in 1991 and 77,600 pounds in 1992 before dropping to 250 pounds by 1998 and returning to zero pounds from 1999 through 2002. The plant posted zero pounds of underground wastewater injection from 1988 through 2002. Land releases increased from zero pounds in 1988 through 1996 to 1,300 pounds in 1997 and 1998 before dropping to 81 pounds in 1999 and zero pounds in 2000. Land releases increased to 1,243 pounds in 2001 and 3,466 pounds in 2002. The Environmental Defense Fund's Scorecard results came from integrating more than 400 scientific and governmental databases. [5]

According to the Environmental Protection Agency's Toxic Release Inventory and self-reporting by CFAC, the aluminum smelter emitted more than 4 million pounds of hydrogen fluoride from fugitive potroom emissions and point-source stack emissions from 1988 to 2009, with five years of no data. Fluoride was a component of the molten bath in which alumina was electrolytically reduced to aluminum metal. From 1995 to

2009, CFAC emitted 192,797 pounds of polycyclic aromatic compounds in the air and by surface impoundment. Polycyclic aromatic compounds were released by the carbon paste plant or the open tops of the Soderberg-type anodes. In 1988, CFAC released more than 2.5 million pounds of aluminum oxide, or alumina – the raw material that was smelted to aluminum metal. From 1996 to 2000, CFAC released 273,182 pounds of carbonyl sulfide in the air – another emission from the paste plant and Soderberg anodes. From 1991 through 1995, CFAC released 2,350 pounds of cyanide via surface water. Cyanide was produced inside the reduction cells over years of operation and was released to the environment when spent potliner was removed from cathode pot bottoms before the steel shells were rebuilt and then dumped in unlined landfills on site, where it subsequently drained into groundwater. [6]

In 1992 and 1993, CFAC and the Plum Creek timber mills were among the EPA's top-10 polluters in Montana, but the amount of emissions showed a slight decrease in those two years. CFAC was fifth on the list in 1993 with 215,399 pounds, a drop from 317,350 pounds in 1992. CFAC Spokesman Allen Barkley said production curtailment to 75% in early 1993 explained virtually all of that reduction. Plum Creek's medium-density fiberboard plant in Columbia Falls was eighth on the list, with 101,350 pounds of emissions in 1993, down from 110,500 pounds in 1992. Plum Creek environmental engineer Mitchell Leu explained the change by noting that extensive stack testing in 1993 reflected "real numbers" as opposed to using averages in 1992. Leu said he expected emissions at the MDF plant to increase in 1994 with increased fiberboard production. The MDF plant emitted formaldehyde and ammonia as part of the process of gluing wood fibers into panel products. [7]

The EPA's toxic release inventory for 2000 ranked Plum Creek's MDF plant in Columbia Falls as No. 9 in Montana for on-site and off-site releases for all chemicals with 783,250 pounds of air emissions and no water releases. CFAC ranked No. 10 that year with 345,731 pounds of air emissions and no water releases. CFAC ranked No. 1 in Montana for on-site releases of persistent bio-accumulative toxic chemicals with 36,535 pounds of air emissions and no water releases. CFAC also ranked No. 10 in Montana for on-site and off-site production-related waste of all chemicals with 9.3 million pounds of air emissions and no water releases. CFAC ranked No. 1 in Montana for on-site and off-site production-related waste for persistent bio-accumulative toxic chemicals with 2,217 pounds of air emissions and no water releases. [8]

CFAC was not alone for environmental impacts among the Pacific Northwest's 10 aluminum smelters. According to a 1985 final environmental impact statement by the Bonneville Power Administration, the Pacific Northwest's aluminum plants discharged about 685.31 tons of fluoride per year into water near the plants. These fluoride discharges included: Alcoa in Vancouver – 13.16 tons in the Columbia River; Alcoa in Wenatchee – 74.84 tons in the Columbia River; Alcoa's Intalco plant in Ferndale – 47.38 in Puget Sound and the Straits of Georgia; CFAC – 12.89 tons in on-site ponds with no evidence that this wastewater migrated into the nearby Flathead River; Comalco in Goldendale – 122 tons in the Columbia River; Kaiser's Mead plant in Spokane – 119.11 tons in Peone Creek, which drained into the Columbia River; Kaiser in Tacoma – 5.22 tons in the Hylebos Waterway and Puget Sound; Martin Marietta at The Dalles – 60.92 tons in the Columbia River; Reynolds in Longview – 166.32 tons in the Columbia River; and Reynolds in Troutdale – 63.36 tons in the Columbia River. [9]

Annual atmospheric emissions by the region's 10 aluminum smelters in 1985 according to the BPA included: Alcoa in Vancouver – 678 tons particulates, 185 tons fluorides, 30 tons hydrocarbons, 1,276 tons sulfur oxides and 7,023 tons carbon dioxide; Alcoa in Wenatchee – 1,368 tons particulates, 495 tons fluorides, 401 tons hydrocarbons and 2,737 tons sulfur oxides; Alcoa in Ferndale – 620 tons particulates, 117 tons fluoride, 9 tons hydrocarbons, 5,082 tons sulfur oxides and 37,205 tons carbon dioxides; CFAC – 837 tons particulates, 456 tons fluoride, 624 tons hydrocarbons and 1,850 tons sulfur oxides; Comalco in Goldendale – 595 tons particulates, 161 tons fluoride and 633 tons sulfur oxides; Kaiser in Tacoma – 600 tons particulates, 158 tons fluoride, 36 tons hydrocarbon, 1,941 tons sulfur oxides and 11,336 tons carbon dioxide; Kaiser in Spokane – 1,544 tons particulates, 685 tons fluoride, 404 tons sulfur oxides and 24,132 tons carbon dioxide; Martin Marietta at The Dalles – 435 tons particulates, 102 tons fluoride, 503 tons sulfur oxides and 15,926 tons carbon dioxides; Reynolds in Longview – 1,575 tons particulates and 263 tons fluoride; Reynolds in Troutdale – 877 tons particulates, 162 tons fluoride, 2,799 tons sulfur oxides and 12,822 tons carbon dioxide. [10]

This level of pollution by the Pacific Northwest's aluminum industry drew a wide range of public comments when the BPA drafted an environmental impact statement for power sale options to direct-service industries in 1986. Sid Gould of Seattle told the BPA that taking money from the aluminum plants was a bad idea, and the 14 people in his neighborhood with whom he had talked with had agreed with him. "Aluminum plants shouldn't even be in service," Gould said. "Aluminum waste is bad for the environment. It kills animals – whales. Get rid of aluminum plants." The BPA responded by saying that "production of aluminum from some of the plants was an important part of the World War II effort and, today, is an important national commodity." Furthermore, power sales to the direct-service industries provided the BPA with "roughly one-third of its revenues and a substantial part of its operating reserves, which helps to keep rates to other customers lower." The BPA also noted, "Because of regulatory controls, these smelters, as a general rule, do not result in levels of environmental impact that are viewed as excessive by most people or by those who regulate the smelters." Walter Hoffman, a consulting electrical engineer in Portland, expressed his support for the aluminum smelters. "I believe it is incumbent upon those in authority to have an even broader vision of the environment impacted," he said. "What does it mean to the United States of America if we abdicate our position as a major producer of aluminum? We are all witnesses to the depressing erosion of this country's industrial base." While other industrial setbacks might have been caused by factors beyond government control, saving the aluminum industry was something the government could do, he said. [11]

The BPA published its final environmental impact statement for power sale options to direct-service industries in April 1986. The DSIs, including the region's 10 aluminum plants, had power sales contracts through June 30, 2001, which were offered in accordance with the 1980 Northwest Power Act. The BPA's goal was to reduce load fluctuations and revenue uncertainty, and the agency considered impacts to the environment by aluminum plants to be "predominantly localized." Environmental factors of concern noted in the Final EIS included impacts to aluminum plant operations, impacts to air and water, and socioeconomic impacts – particularly jobs. "The socioeconomic effects of the proposals are a significant concern that has been raised by aluminum company employees, unions, representatives of communities where smelters are located, and others throughout the region concerned with electricity rates," the Final EIS said. In general, the BPA considered the possibility of increased air or water pollution as a result of increased aluminum production not to be a major concern for this particular study because the BPA assumed all aluminum smelters operated within pollution limits set by state governments – even if a plant increased production, it still would have to keep its emissions within approved limits. [12]

Dealing with emissions

The Anaconda Aluminum Co. smelter in Columbia Falls was blamed for killing trees on public and private land for miles around the plant, especially after the company completed expanding operations from two potlines to five by 1968 , when fluoride emissions climbed to possibly as high as 10,000 pounds per day. Controlling those emissions required modifying the plant's 600 Soderberg-style pots to an improved Sumitomo process and installing dry scrubbers to remove fluoride from collected pot gases. Alcoa, which developed the Method 398 dry scrubber, first began to install the dry scrubbers in its plants in 1967. By 1971, Alcoa had installed a total of 123 Method 398 reactors at eight different locations, including three Soderberg plants. [13] The Montana Department of Environmental Quality issued a permit to AAC for the installation of a dry scrubber system on July 16, 1976. Ten dry-scrubber reactors were installed at two locations at the AAC smelter – four for the West Plant and six for the East Plant. AAC also obtained technology from the Sumitomo Chemical Co., which included structural-engineering design changes to the reduction pots, operational and process changes, and new raw materials. In addition to reduced particulate and fluoride emissions, benefits from changing the reduction pots included reduced power consumption, longer life spans for reduction cells and fewer man-hours required for operating and maintaining the facility. [14]

The conversion from the plant's original wet scrubbers to the new dry scrubber system began in 1976. By January 1977, about one-third of the plant's reduction pots were connected to the new system. Installation of the new system was completed and put on line by Dec. 22, 1978. [15] By February 1980, all 600 reduction pots at the AAC plant had been converted to the Sumitomo process. "All environmental aspects of the project appear very promising," Don McMillan, the project manager for the conversion project, said at the time. "Other areas of performance, including energy consumption, chemical and carbon consumption and production output, are also looking good." Other modernization efforts planned for 1980 included the experimental trial of air pollution control units from France, which would be mounted on the roofs of the pot rooms to reduce secondary emissions, and the experimental trial of new air pollution monitoring equipment. In April 1980, the AAC plant's fluoride emissions averaged 738 pounds of fluoride per day, well below the state air quality standard of 864 pounds. It should be noted that the plant was not operating at 100% capacity at the time. [16] The big conversion brought the plant within the state's fluoride emission standards, reduced electrical use by 15% and improved working conditions inside the pot rooms. [17]

On July 17, 1980, the Hungry Horse News congratulated the AAC plant as it celebrated its 25th anniversary, commending the company for reducing air pollution and installing energy-conserving equipment. "Notable changes are evident, not only in the physical plant but in the company's concerns," the newspaper said. "The environment is the biggest and possibly the most important." [18] With the main potline fluoride emission problem mostly addressed by 1980, AAC also made improvements to particulate emissions at its rail car unloading facilities. In 1981, the Montana Department of Health and Environmental Sciences issued permits to convert AAC's East Plant and West Plant alumina unloading facilities from shaker-type to pulse-jet baghouses to improve control of alumina dust emissions. In 1983, the state issued a permit for the installation of a baghouse for the West Plant alumina storage silo conveyor. In 1996, the state altered existing air pollution permits for the conversion of baghouses from shaker-type to pulse jets for the West Plant alumina storage silo conveyor and the East Plant alumina unloader bucket elevator. [19]

AAC also made improvements at its carbon paste plant. Air pollution at the paste plant included particulates emitted by rail car unloading and raw material processing and fumes emitted by hot coal tar pitch. In the early years, the paste plant used anthracite coal and petroleum coke mixed with liquid coal tar pitch to produce anode briquettes that were added to the open-topped Soderberg anodes to replenish the carbon that burned off the bottom of the anode during smelting. Raw coal and coke were ground to different levels of coarseness in a ball mill and sorted by vibrating screens, which could produce fugitive carbon dust. Over time, the plant no longer used anthracite coal. The different kinds of ground coke were combined with coal tar pitch in varying recipes in large industrial-bakery mixers and extruded into briquettes. Coal tar pitch was derived as a byproduct at plants which distilled coal to produce coke. It was a glassy black solid at room temperature but became useful as a liquid for industrial processing at more than 300 degrees Fahrenheit. It was a liquid in AAC's heated storage tanks and in the heated insulated pipes that ran throughout the eight-story paste plant building. Coal tar pitch emissions were common in the paste plant and included a long list of hazardous volatiles that fell within the polycyclic organic matter category. Whereas petroleum coke dust and coal tar pitch fumes were considered carcinogens, coal tar pitch fumes that contained sulfur also could burn exposed skin. Polycyclic organic matter emissions mostly were eliminated in aluminum plants using prebake cells because the carbon paste was baked into shaped electrodes in a specially designed ring furnace that had emission control equipment in place. [20]

CFAC not only provided respirators but also educated its workers on hazards posed by coal tar pitch volatiles. In a 1998 "Business, Safety & Health Newsletter," the company explained that coal tar pitch commonly was used in a variety of products, including roofing materials, pipe coverings and road paving. The three major hazards associated with coal tar pitch were fire, inhalation and skin exposure. Emissions from coal tar pitch included coal tar pitch volatiles which were airborne particles released into the air when pitch was heated, and other gases and vapors. The main volatiles of concern were polycyclic aromatic hydrocarbons, some of which were considered carcinogens, the newsletter said. The coal tar pitch used to manufacture anode briquettes at CFAC contained about 2.5% polycyclic aromatic hydrocarbons by weight. According to the newsletter, the volatiles were present in the plant in various concentrations and were regulated by the federal Occupational Safety and Health Administration, and the cartridge-type respirator supplied by CFAC was capable of filtering out coal tar pitch volatiles emissions. Exposure to pitch dust and vapors could cause irritation to skin, eyes and the respiratory tract. Frequent or prolonged exposure could cause pitch burn to skin, similar to the symptoms of sunburn and made worse by exposure to sunlight. Continued or repeated exposures could cause skin disorders such as dermatitis, tar warts or rough skin. Over many years, continued or repeated exposures could lead to skin pigmentation, benign skin growths and possibly skin cancer. Inhaling coal tar pitch volatiles over a long period of time could cause lung cancer. The newsletter noted that CFAC required long-sleeved shirts and barrier cream to minimize skin exposure. Employees were encouraged to wash their hands and face prior to eating, drinking, smoking or using a restroom. [21]

Other U.S. aluminum companies issued warnings about coal tar pitch volatiles about the same time. Alcoa officials sent letters to smelter workers at the Intalco smelter just before Christmas 1999 warning the workers that they faced a higher risk than previously thought of developing lung or bladder cancer from exposure to coal tar pitch. The new information came from industry studies, including one by Alcan, but Alcoa management were careful not to say how great the risk was or how many workers they had contacted at its 22 smelters company wide. To deal with the issue, Alcoa said it was implementing new safety measures, including increased venting of pitch fumes, increased use of respirators, increased hand-washing, special protective clothing and the barring of eating or smoking in areas exposed to coal tar pitch. According to Mike Wright, director for health, safety and environmental protection for the United Steelworkers, Alcoa began informing its smelter workers about these cancer risks in November 1999, and the union intended to ask Kaiser and Reynolds management to follow a course similar to Alcoa's to protect workers at their smelters. [22]

The reasons for controlling pollution at the carbon paste plant included both employee safety and environmental concerns, and over the years pollution control equipment at AAC's carbon paste plant was replaced or improved. On Oct. 21, 1983, the Montana Department of Health and Environmental Sciences issued the smelter a permit for the installation of several pieces of air pollution control equipment at the paste plant, including a baghouse for the coke and coal unloading facility and a Draco dust-control system for the paste plant. [23] In July 1988, however, the state health department charged CFAC with an air pollution violation after one of its inspectors noticed carbon dust emitted from a stack at the paste plant. CFAC Spokesman Jack Canavan said the incident was considered a violation of the state's visual emission standards and not a health hazard, and he called the proposed civil penalty "excessive." By February 1989, CFAC had agreed to pay a $10,000 fine to the state for the violation. Half the fine would be suspended if the plant improved its paste plant scrubber system. CFAC expected to have a new scrubbing system installed and operational by Dec. 15, 1988. [24]

On April 10, 1989, Montana DEQ issued a permit to CFAC for installation of a wet scrubber to control emissions from the paste plant area. [25] The plant had installed wet scrubbers to control fluoride emissions from pot gases when the plant was first built in the early 1950s. Fluoride emissions from aluminum reduction pots were slightly soluble in water, but the polycyclic organic matter emitted from coal tar pitch was not. The plant had also tried to use wet scrubbers to control secondary fluoride emissions – the particulates and fumes in the pot rooms that vented along with heat through the clamshell rooftop vents. But the insolubility of polycyclic organic matter and the freezing of water used in wet scrubbers during winter made them a poor choice for controlling secondary emissions. Dry scrubbers used to treat primary emissions reacted raw alumina with pot gases – the fluorides bound to the aluminum oxide particles in a reactor vessel, and the reacted alumina later was placed in the reduction pots, thereby recycling fluoride that otherwise would have been lost. A similar principle later was used to control polycyclic organic matter emissions at the paste plant. Collected paste plant fumes were run through a venturi reactor injected with dry coke to adsorb coal tar pitch fumes. The dry coke bound with the pitch fumes and was collected in a pulse-jet baghouse. The reacted coke was then re-used in the paste plant to make anode briquettes. [26]

CFAC and state personnel continued to monitor fluoride emissions from the smelter decades after the Sumitomo conversion and installation of the Alcoa Method 398 dry scrubbers. By 1994, CFAC lab personnel were collecting samples in Glacier National Park once a month, while the state Air Quality Bureau collected samples every 12 days at three locations closer to the smelter. Samples that had been analyzed in CFAC's own lab were sent to a lab in New York. Fluoride levels in plant samples could not exceed 35 ppm in a single sample or 50 ppm on a monthly average. By 1994, the results of CFAC's tests typically showed that ponderosa and lodgepole trees along with grass and forage samples contained about 15 to 20 ppm, well below the state's limits for fluoride in forage, said Ty Wilson, CFAC's quality control coordinator. The company claimed that pollution control equipment installed in the late 1970s recovered about 99.9% of the fluoride in primary emissions, the pot gases. [27]

Tightening regulations

But new air pollution regulations were on the horizon. In June 1993, Don Ryan, CFAC's environmental superintendent, talked to local media about how new federal regulations could affect operation of the aluminum plant. Amendments to the 1970 Clean Air Act passed by Congress in 1990 called for the use of maximum achievable control technology (MACT) by industry for 189 hazardous air pollutants by 1997. For the aluminum industry, this included fluoride and polycyclic organic compounds. Ryan estimated the new regulations could cost CFAC up to $30 million, and noted that the plant would have difficulty reducing fluoride emissions from the current standard of 2.6 pounds per ton of aluminum produced to a future standard of 1.5 pounds. The use of rooftop scrubbers on the pot rooms would be a "horribly expensive" and a last alternative, Ryan said. The plant would first try to improve efficiency in operation of the reduction pots. According to Stephen Fruh, an environmental engineer for the EPA in Durham, N.C., the EPA was about halfway through a four-year data collection and study project of the U.S. aluminum industry, and he expected a proposal for new pollution-control regulations might be available by early 1995, with enforcement of new regulations by 1996 or 1997. [28] CFAC Vice President Lee Smith said tougher federal air pollution laws could create additional financial pressure on the aluminum plant. In the worst case scenario, the plant could be required to install wet scrubbers on the roofs of the potrooms, Smith said. The last time the plant looked into that kind of system, it was estimated to cost $30 million, provide only 50% efficiency and pose serious freezing problems in winter. "We'd be in trouble" if such equipment was mandated, Smith said. [29]

Mary Nichols, the No. 2 person in the EPA for air quality, visited the CFAC smelter on Dec. 7, 1994. Arrangements for the visit were made with help from Sen. Max Baucus. During the two-hour visit, CFAC management talked with Nichols about the 1990 Clean Air Act's requirement that industries use maximum available control technologies to prevent air pollution. The U.S. aluminum industry had been working closely with the EPA to develop the new rules. MACT rules for each plant would be different because the plants were designed differently and operated under different climates and conditions. CFAC management also discussed with Nichols the issue of the city of Columbia Falls' nonattainment status for particulate pollution – mostly the result of dust from unpaved streets and parking lots. The city had been in nonattainment status since 1984, but city and industry leaders claimed the city's air had not exceeded EPA particulate standards for about six years, and the nonattainment status should have been lifted three years earlier in 1991. The EPA had not lifted the status because of uncertainty over the amount of particulates contributed to the city's air by local industry. EPA tests never showed any evidence of alumina, the primary particulate produced by the CFAC plant, but the EPA's computerized pollution models indicated that CFAC and Plum Creek should be contributing significantly to the city's air pollution. CFAC had established a weather station and air monitoring station to conduct tests of its own, and the company could find no evidence of alumina particulates in the immediate airshed. "Obviously, we emit particulate, but because of the way the wind patterns are, that doesn't mean we are going to contribute to the concentrations of particulate in Columbia Falls," CFAC Spokesman Allen Barkley said. He called the tests academic since the city's air had not exceeded the EPA's minimum particulate standards for six years. [30]

The EPA announced the formation of the MACT partnership on March 29, 1995. The 1990 Clean Air Act had established revised national emission standards for hazardous air pollutants that in turn required the EPA to establish dozens of maximum achievable control technology standards. Under the MACT partnership program, the EPA would work closely with state and local governments and industry to develop the best methods to control air pollution. In the U.S. aluminum industry, some of the emission testing was carried out with joint funding from the EPA, the Washington State Department of Ecology and the aluminum industry. After eighteen months of study, the EPA published the proposed MACT standards for primary aluminum plants as developed through the MACT partnership on Sept. 26, 1996. The proposed standards would be added to federal regulations to specify stringent controls for hazardous air pollutants at primary aluminum plants. [31]

According to the MACT standards, the two major types of hazardous air pollutants found at primary aluminum plants were fluoride and polycyclic organic matter – the latter contained anthracene, benzo(a)pyrene, naphthalene and other organic compounds. The EPA estimated that the 23 primary aluminum plants in the U.S. emitted 6,400 tons per year of fluoride emissions and 3,200 tons per year of polycyclic organic matter. The first step in establishing maximum achievable control technology was to define a MACT floor. For existing aluminum plants, the MACT floor was based on emission levels achieved by the top 12% of aluminum producers. For new aluminum plants, the MACT floor would be based on emission levels of the best producer. Although the EPA could have imposed more stringent levels, it chose to set MACT floor levels based on existing plants and to allow emission averaging. The EPA estimated that implementation of the proposed requirements would reduce fluoride emissions by nearly 50%, reduce polycyclic organic matter emissions by nearly 45% and reduce particulate emissions by 16,000 tons per year. The CFAC smelter was classified under these regulations as a vertical-stud Soderberg Type 2 plant, and emission limits were set at 2.7 pounds total fluoride per ton of aluminum produced and 3.7 pounds of polycyclic organic matter per ton of aluminum produced. CFAC was allowed to average its emissions across the five potlines in operation, which reduced the emission standards to 2.4 pounds total fluoride and 3.1 pounds polycyclic organic matter. For paste plants such as the one at CFAC, fumes from pitch and other materials would have to be captured in a closed venting system and then routed to a dry coke scrubber system. [32]

The final MACT standards were published on Oct. 7, 1997. The emission limit for polycyclic organic matter was reduced from 3.7 pounds per ton of aluminum produced to 3.6 pounds. When averaging emissions over five potlines, the emission limit for polycyclic organic matter was reduced from 3.1 pounds to 2.9 pounds. The compliance schedule for all existing primary aluminum plants was Oct. 7, 1999. Two new test methods also were promulgated – Method 14A to determine total fluoride from selected sources and Method 315 to determine particulate and methylene chloride from selected sources. [33] CFAC informed workers about capital projects aimed at maintaining compliance with the 1990 Clean Air Act and MACT standards in a Nov. 5, 1997 in-house newsletter. A number of projects had been developed and were expected to go into effect by Oct. 7, 1999. To meet those standards, CFAC allocated $1.7 million for a new dry scrubber system for the paste plant, $690,000 for potroom rooftop manifolds for the Method 14 air monitoring stations, and $250,000 for flow monitoring equipment for the West Plant and East Plant pot-gas dry-scrubber systems. [34] An updated version of the federal air pollution rules was in the works by October 2001 when the Aluminum Association reviewed the draft language on compliance and regulations for the Secondary MACT rule. The EPA said a proposal and comment period would be published in May 2002 and a final rule would be made in December 2002. [35] By that time, CFAC had closed for a year during the West Coast Energy Crisis and never restarted beyond 60% capacity.

The 1997 rules and regulations created under the umbrella of the 1990 Clean Air Act covered all aspects of primary aluminum smelters, including materials shipping and receiving, potlines, maintenance and repair shops, casting facilities, paste plants and prebake furnaces, and rectifier facilities. The Clean Air Act had directed the EPA to investigate industries across the U.S. and to develop standards and regulations. Every primary aluminum smelter using the electrolytic reduction process was subject to these rules with no exception. Different rules were being developed for secondary aluminum processing facilities. “Short-term inhalation exposure to gaseous hydrogen fluoride and related fluoride compounds can cause severe respiratory damage in humans,” the EPA stated in a review of the new rules. “Long-term inhalation exposure to low levels of hydrogen fluoride by humans has been reported to result in irritation and congestion of the nose, throat and bronchi while damage to liver, kidney and lungs has been observed in animals. Polycyclic organic matter includes a combination of polycyclic aromatic hydrocarbons such as anthracene, benzo(a)pyrene, and naphthalene, among others. Several of the polycyclic aromatic hydrocarbon compounds, including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene, are probable human carcinogens, and cancer is the major concern from exposure to these polycyclic aromatic hydrocarbons.” [36]

To meet compliance, the 1997 rules and regulations provided two options for aluminum companies – meet the emission limits for each individual potline, or average emissions from multiple existing potlines. Special rules were created for newly built potlines versus existing ones, for modified potlines, and for plants with a combination of Soderberg and prebake facilities. Primary emissions included exhaust gases and particulates collected from the reduction cells and treated by a dry scrubber system. Secondary emissions were exhaust gases and particulates which escaped the reduction cells and then vented through the roofs of the potrooms. "The pots are large heat sources," the EPA stated in its review of the new rules. "Consequently, the potrooms are ventilated to maintain reasonable working conditions and to help with proper pot operation. Usually this ventilation air enters at the sides of a potroom and exits through roof vents (roof monitor). This ventilation is the major source of potroom fugitive emissions." The new rules specified the type of monitoring required, including monthly measurements of total fluoride in secondary emissions, annual measurements of total fluoride in primary emissions, quarterly monitoring of polycyclic organic matter in secondary emissions, annual measurements of polycyclic organic matter in primary emissions, continuous parameter monitoring of emission-control devices, monitoring of daily weights of aluminum produced and daily visual inspections of exhaust stacks. The 1997 rules and regulations required aluminum plants to initiate corrective actions within one hour if a primary control device measured an operating parameter outside the established limits. Primary control devices were not to exceed the limits more than six times in a semi-annual reporting period. [37]

Greenhouse gases

In addition to the MACT standards, the EPA launched the Voluntary Aluminum Industry Partnership (VAIP) program with 10 U.S. companies in April 1995. Two more companies joined soon afterwards. The goal was to reduce perfluorocarbon emissions, a potent greenhouse gas. Aluminum smelters using the Hall-Heroult alumina reduction process inevitably produced carbon dioxide, as the carbon in the anodes burned off and consumed the oxygen in the alumina, leaving aluminum metal behind in the cathode pot bottom. But aluminum smelters also were the source of two perfluorocarbons – tetrafluoromethane and hexafluoroethane. The EPA's goal was to work through the voluntary program to reduce perfluorocarbon emissions at 22 U.S. primary aluminum smelters by 45% by the year 2000 through changes in management and incremental technological changes. Strategies included reducing the frequency and duration of anode effects, a significant source of perfluorocarbons. Anode effects, which were caused by gas bubbles forming between the anode and the bath, also wasted electrical power, but with current technology a limited number were thought to be unavoidable to smelter operation. The EPA was conducting research on anode effects at the Massachusetts Institute of Technology. [38] By September 1997, nearly 94% of U.S. aluminum plants were participants in the program. The 12 voluntary company partners included Alcan, Alcoa, Alumax, Century Aluminum, CFAC, Goldendale Aluminum, Kaiser, Noranda, Northwest Aluminum, NSA-Southwire, Reynolds and Vanalco. CFAC was reducing its perfluorocarbon emissions by using a computerized anode-effect suppression system which acted at a preset voltage to reduce the duration of the anode effect. The company was also studying ways to optimize the alumina feed rate to the reduction pots. [39]

Other EPA-sponsored environmental programs that U.S. aluminum producers participated in included the 33/50 program to reduce toxic air pollutants, Green Lights and Waste Wise. [40] The Aluminum Association also offered its trade association members both advice and training for environmental issues – sometimes in how to prevent pollution and sometimes in how to avoid legal or public opposition problems. In 1998, the Aluminum Association scheduled a two-day workshop on pollution prevention that included presentations on state pollution prevention programs, with a focus on the Ohio EPA; the environmentalist agenda, with a focus on the Environmental Defense Fund; industry views on progress and challenges, presented by Cur Wells and the Reynolds Metal Co.; spent potliner recovery; environmental management of smelters; management of agricultural buffer land surrounding a prebake smelter; implementation of the U.S. Clean Air Act; wastewater recovery; baghouse technology; a public acceptance-oriented approach to new plant construction; impoundment of red mud from alumina refining; corporate stewardship and wildlife conservation; plant-wide pollution prevention programs; chlorine reduction; and recycling of refractory brick. [41]

Results from a study monitoring perfluorocarbon emissions at several aluminum smelters in the Pacific Northwest were issued on Feb. 15, 1998. The climate change-related study was part of the Voluntary Aluminum Industrial Partnership program. Perfluorocarbons emitted by aluminum plants primarily were byproducts emitted during anode effects at aluminum smelters. In terms of "global warming potential," one ton of tetrafluoromethane produced the same effect as 6,500 tons of carbon dioxide, and one ton of hexafluoroethane produced the same effect as 9,200 tons of carbon dioxide. Both gases were characterized by "strong infrared radiation absorption and relative inertness in the atmosphere." The EPA estimated the annual output of perfluorocarbons from U.S. aluminum plants in 1990 at about 2,700 tons, equivalent to 18 million tons of carbon dioxide. For the study, perfluorocarbons were monitored at exhaust ducts from primary treatment equipment and at potroom roofs, typically using the EPA Method 14 monitoring system collectors. Both Northwest Aluminum at The Dalles and Goldendale Aluminum had scrubber systems on potroom roofs. The study found that fugitive emissions from rooftops accounted for 10% to 33% of exhaust emissions of perfluorocarbons for smelters using vertical-stud Soderberg pots. [42]

The study also compared perfluorocarbon output with anode effects. Among the three plants with vertical-stud Soderberg pots, CFAC averaged 9.78 anode-effect minutes per cell-day, compared to 5.37 at The Dalles and 2.54 at Goldendale. Kaiser at Tacoma, utilizing horizontal-stud Soderberg pots, recorded 2.82 anode-effect minutes per cell-day. Among the plants with prebake pots, Vanalco had 2.97 anode-effect minutes per cell-day and Kaiser at Mead had 1.42. The amount of perfluorocarbons emitted varied proportionately to the number of anode effects, and CFAC scored the highest on output of tetrafluoromethane and hexafluorethane. The interior of vertical-stud Soderberg pots were opened to the potroom atmosphere when the crust was broken to extinguish an anode effect. CFAC also scored significantly higher in the number of anode effects per cell-day – 3.43 compared to 1.92 for The Dalles. The average number of anode effects per cell-day for prebake plants was 0.87. CFAC scored lower for average duration of anode effect, but overall CFAC scored significantly higher for weight of perfluorocarbon per ton of aluminum produced and for the ratio of tetrafluoromethane to hexafluorethane produced. [43]

In July 1999, the Voluntary Aluminum Industrial Partnership submitted a report to the United Nations Framework Convention on Climate Change describing the program's goal to reduce perfluorocarbons. In June 1999, the partnership group jointly set company-specific emission reduction targets with the goal of reducing perfluorocarbons by 45% from 1990 levels by the year 2000, assuming production levels were similar for those years. The effect on global warming would be the same as reducing carbon dioxide emissions by 8 million tons per year. The share of perfluorocarbon emissions by the 12 companies in the report included Alcoa 34%, Alumax 14%, Reynolds 11%, Kaiser 7%, Century 5%, Noranda 5%, Southwire 4%, Alcan 4%, CFAC 4%, Goldendale 4%, Vanalco 3% and Northwest Aluminum 2%. The primary approach to reducing perfluorocarbon emissions was to reduce the frequency and duration of anode effects. Studies had determined that perfluorocarbons were only emitted during anode effects. [44] It was also believed that the frequency and duration of anode effects was related to the ratio of chemicals and alumina in the bath.

Perfluorocarbon emissions by U.S. aluminum producers fell by about 2 million tons of carbon dioxide equivalent from 1990 to 1997 as a result of reductions in domestic aluminum production and actions taken by the voluntary partnership. Methods used to reduce perfluorocarbon emissions included: 1) best management practices, including educating employees, supplying workers with the tools to monitor alumina concentrations, and regular team meetings; 2) technical initiatives, including state-of-the-art technologies such as computerized anode effect suppression systems and controlling alumina supply by point-feed systems; 3) research initiatives, with a special focus on developing some type of non-consumable inert anode, which would eliminate carbon burning. The report noted that a joint research effort between U.S. aluminum producers and the U.S. Department of Energy "do not anticipate a commercially viable inert anode design for 10-15 years." [45]

According to the 1999 United Nations report, Alcan spent $1.6 million on demand-feed systems at its Sebree plant, which accomplished measurable perfluorocarbon reductions by May 1998. Alcoa reported reducing perfluorocarbon emissions by 70% since 1990 through increased attention by its workforce. Century Aluminum and CFAC reported using computerized feed control and a better educated workforce. Goldendale focused on employee involvement with the aim of saving energy costs. Kaiser was focused on educating its workforce and studying feed-control systems. Noranda began improving its computer controls in 1983 and reported a 70% reduction in anode effects since 1990. Northwest Aluminum had installed a computerized anode-effect suppression system. Southwire continued to improve its computer controls. Reynolds reported reducing anode effects by 42% since 1970. Vanalco, with the oldest operating potlines in the U.S., reported a reduction in anode effects from 1.81 per pot per day in 1990 to 0.52 in 1999, a 71% reduction. A computer control system installed in 1998 to 1999 made the difference, Vanalco reported. [46] On Feb. 14, 2002, President George Bush recognized the 12 U.S. aluminum companies that made up the Voluntary Aluminum Industrial Partnership for achieving their goal to reduce perfluorocarbon emissions by 45% in 2001 – equivalent to eliminating about 1.8 million tons of carbon. [47]

Emission incidents

In spring 1995, CFAC found itself in violation of its state air pollution permit as it restarted a quarter of its potlines, which had been shut down for about two years. During the summer, emissions exceeded Montana's standard of 2.6 pounds of fluoride per ton of aluminum produced. Company reports for July, August and November of 1995 showed fluoride emissions exceeded the standard. On Sept. 18, 1995, Robert Booher at the Montana Air Quality Bureau reported that the company was working diligently to correct the problem and no citations had been issued. The standard for the plant at partial capacity was about 250 pounds of fluoride per day and the plant emitted "well above 400 pounds in June and July," Booher said. The amount came down closer to 300 pounds during August and September. Booher explained that this was the first potline restart at the plant since 1982, when the plant was modernized to control fluoride emissions. "A lot of people who were experienced with start-up are gone," he pointed out. The former Montana Air Quality Bureau monitor who was familiar with CFAC's restart process had also left. "We're basically just watching the situation at this point," Booher said. "They seem to be working very hard on it." Plant managers claimed the violations were caused by start-up difficulties which were addressed by start-up and shut-down exemptions. While the bureau believed the company had made a good faith effort to solve the problems quickly, that didn't necessarily exempt them from any kind of enforcement action, and a notice of violation was issued. In April 1998, the DEQ announced it would give the $32,000 from the fine CFAC paid for the 1995 violations to the city of Columbia Falls. The city planned to use the money to purchase a $90,000 street sweeper. The city was required to have a street-sweeping program in place in order to meet federal air quality standards for particulates. [48]

A major unanticipated equipment failure in March 1996 became a much reported environmental incident when a bypass duct in CFAC's West Plant air pollution control system collapsed and fell to the ground during high winds. CFAC said no emissions were released in a report to the Montana Department of Environmental Quality, but during the repair work CFAC personnel discovered that much of the associated ductwork was corroded or plugged. A repair project was scheduled for November, a window of opportunity between the end of the agricultural growing season and prior to winter inversion conditions in the Flathead Valley. CFAC applied to the state for a variance from air quality regulations while the work took place. The project was estimated to take 67 hours and cost more than $500,000. Excess fluoride emissions would be generated during the repairs, but a special cartridge filtering system would be used while the dry scrubber system was out of service. The cartridge system was expected to collect 99.5% of the plant's particulate emissions, but it would not be effective in collecting gaseous hydrogen fluoride emissions. Total fluoride emissions during the 67-hour repair window were estimated to reach 6.8 tons. To fully comply with state fluoride regulations, the plant would have to shut down all 600 reduction pots, but that would cause a hardship with $7.5 million in restarting costs, and production delays could put the plant into default with its tolling customers. [49]

The ductwork project coincided with poor aluminum market conditions. The Wall Street Journal reported on Oct. 4 that "major aluminum makers, hammered by sagging prices, were expected to post lower third-quarter earnings." The average price of aluminum metal had fallen 22% to 65 cents per pound in the first quarter and fallen another 7% in the second quarter. High inventories, especially in foreign markets, were blamed for the decline. CFAC General Manager Larry Tate said he believed that price trends were cyclical and that he was confident demand would soon rise again. The costly repair to the air pollution control equipment came at a bad time, but it was "the right thing to do," he said. [50] The cost of the project had reached $750,000 by October. Engineers who inspected the damage had found several other locations where ductwork was corroded and needed repair. Half of the $750,000 cost would pay for the portable filter system. Plant managers also expected to lose about 65 tons of metal production during the repair. Plant managers were awaiting word from the Montana DEQ about an air pollution variance and expected the project to start by Nov. 8. [51]

On Oct. 21, 1996, the Columbia Falls City Council voted 6-1 to help CFAC obtain the needed variance by sending a letter to the DEQ endorsing CFAC's proposal to repair the

20-year-old ductwork. The vote came after a lengthy presentation by CFAC engineers. "The ductwork hasn't failed yet, but it will begin to fail, and it will fail soon," Tom Payne told the council. Temporary filter units would prevent dust emission, which was good for the city, which was seeking to upgrade its PM-10 air pollution status, but the units would only prevent 50% of the hydrogen fluoride in pot gas from leaving the plant. Temporary measures during repair work also would include throttling down the potlines. The plant would end up emitting as much fluoride in three days as it normally did in 12 days. Shutting down the plant during the repair work would make matters worse because the restart process would cause even more fluoride emissions, Payne said. The pots would have to be heated to a much higher temperature during a restart, he said. The emissions variance would allow CFAC to exceed state fluoride limits by four times the allowed amount during the three-day project. Councilor Roger Newman cast the lone dissenting vote, saying the council should not lend political credibility to a technical project its members didn't understand. [52]

By late October, CFAC had obtained the variance it needed from the DEQ, but heavy snow delayed the project. The DEQ was monitoring the project after the earlier ductwork failure released about 3.3 tons of pollution. [53] The DEQ's Charles Homer said the increased fluoride emissions during the repair work were not expected to affect air quality in Columbia Falls. That was important news for the city, which had been arguing for some time that the EPA should lift the city's nonattainment status that it earned years ago when particulate levels exceeded the legal limit. The city, Plum Creek and CFAC had cleaned up emissions and particulate levels and maintained attainment status for the EPA's three-year time limit. The reluctance of the EPA to lift the nonattainment designation might be attributable to air pollution sources outside the city, Columbia Falls Mayor Lyle Christman told local media, including slash burning in surrounding forests by the Forest Service. According to the DEQ's Gretchen Bennitt, the city was in a difficult position. If an air quality violation was reported, the city could be sent back into another three-year nonattainment period. Such a violation would not only hurt the city's chances for redesignation, but it would increase the status from moderate to serious, Bennitt said. She said she had been negotiating with the EPA to lift the nonattainment status, but the EPA continued to stall and demand more studies. [54]

According to front-page stories in local newspapers, crews began the ductwork project on Nov. 12, 1996, at 9 a.m. The project was expected to take 26 hours to complete. "Once you start something like this, you can't stop," CFAC Environmental Manager Steve Wright said. "We want to get done as quickly as possible, so we'll be working around the clock." An outside contractor brought in 25 people from the Columbia Falls area to do the work. [55] The dry scrubber system was not restored until 21 hours later on Nov. 13 at 6:20 a.m. A malfunction took place when a flexible elbow between two pieces of temporary ductwork began to break apart, according to Karen Clavin, an environmental engineer with the DEQ. Unable to route pot gas to the temporary baghouse, the plant vented the gases directly into the atmosphere, she said. It was impossible to route the gases back to the dry scrubber system since connecting ductwork already had been taken apart. An estimated 2.2 tons of fluoride was released to the atmosphere, of which 1.3 tons was gaseous hydrogen fluoride and 0.9 tons was fluoride particulates. Some work remained to be completed the following week, and Clavin said the state had insisted on higher quality material for temporary ducting. Clavin pointed out that public health was not endangered and conceded that local air pollution monitors were not running at the time of the malfunction. [56] Clavin said she saw a "good plume rise that day," but the emissions easily dissipated into the air. She also noted that there was nothing CFAC could have done to avoid the emissions. "All the specifications they had for that duct showed it could handle the amount and temperature of the gas and the particulate that would be going through there," she said. [57]

According to OSHA standards, hydrogen fluoride that was 800 feet in the air for eight hours and reached 3 ppm posed a human health hazard. The level during the CFAC incident reached 0.18 ppm, Clavin said. CFAC planned to use heavier gauge material instead of a flexible material for the temporary bypass when it started the next part of the repair job. The company also planned to test the setup for two hours before disconnecting the main ducts. [58] The accident drew criticism from Katherine Cross, a Flathead Valley resident, and from the Montana Environmental Information Center. According to Cross, "a huge brown cloud" darkened the sky above the plant during the breakdown. A temperature inversion added to the problem by suspending the cloud of particulates over the plant. MEIC, which had objected to the company's air pollution variance at a hearing one week earlier, argued that the state air pollution agencies were hastening to make conclusions before any data was available. [59] The DEQ gave CFAC permission to continue repair work on the ductwork on Nov. 15. CFAC said it planned to use steel ducting instead of non-metal tubing for the second phase of the project. CFAC personnel also promised to test the portable baghouse more thoroughly before switching to it entirely during the repair work. [60] Crews completed the project on Dec. 4. That included applying additional layers of fiberglass and aluminum sheeting to the outside of the ductwork for insulation and weatherproofing. Tom Payne said the $750,000 job was one of the most difficult projects ever completed by CFAC, but the job took 51.2 hours instead of the anticipated 67 hours. [61]

Staying in compliance

CFAC had one major air pollution violation between 1997 and 1998, and the EPA fined the company $255,980. [62] The new MACT rules and regulations went into effect on Oct. 7, 1999. The total fluoride limit at the plant was 2.4 pounds per ton of aluminum produced for a five-potline average. The polycyclic organic matter limit was 3.6 pounds for a single potline or 2.9 pounds for a five-potline average. Total fluoride was a monthly standard, and polycyclic organic matter was a quarterly standard, and both were reported quarterly. Compliance was measured by manual sampling of air emissions. Each potline was sampled a minimum of three times per month for total fluoride and once per month for polycyclic organic matter, and each sample period encompassed an entire pot cycle of 48 hours. Brian Hohn, a CFAC environmental engineer, stated in a Nov. 24, 1999 CFAC newsletter that the plant met the total fluoride limit while polycyclic organic matter readings ranged from 2.32 pounds to 4.08 pounds, exceeding the new MACT standard. [63]

In the last quarter of 1999, three potlines were not in compliance for the single-potline emissions limit for polycyclic organic matter. CFAC reported the situation to the DEQ on Feb. 11, 2000 – the first MACT report ever issued by CFAC for the DEQ. The report indicated that CFAC was in compliance for fluoride emissions for the five-potline average, but the polycyclic organic matter problem continued. CFAC was unable to demonstrate compliance with the single-potline limit or the five-potline average limit for polycyclic organic matter from the time of the Feb. 11 report through the plant’s complete shutdown in January 2001 during the West Coast Energy Crisis. CFAC was able to comply with the MACT fluoride emission limit during that time period. Plant personnel and contractors analyzed the problem but were unable to conclusively discover the source of the polycyclic organic matter. Personnel assumed the problem was caused by testing equipment, methodology or analysis. Other suggested explanations included impacts from the new dry scrubber system at the paste plant, a new supplier for coal tar pitch and changes in operations at CFAC. As a result, extensive contractor and in-house testing ensued.[64]

The DEQ issued Glencore an air pollution permit for the smelter plant on Dec. 26, 1999, following transfer of ownership of the plant from CFAC to Glencore. The facility was renamed Columbia Falls Aluminum Co. LLC and continued to be referred to as CFAC. The permit included testing for fluorides and polycyclic organic matter at the Method 398 dry scrubbers and the Method 14 monitoring manifolds on the rooftop clamshells. CFAC opted in its implementation plan to demonstrate compliance with the five-potline average for fluoride and the single-potline limit for polycyclic organic matter. But the plant’s difficulties in bringing down polycyclic organic material readings persisted. On

June 14, 2000, CFAC revised its implementation plan to do five-potline averaging for polycyclic organic matter. [65] On Nov. 16, 2001, the Montana Board of Environmental Review listened to CFAC's appeal "for a hearing and a change of permit condition regarding the inclusion of an alternative (polycyclic organic material) compliance schedule." The case was assigned to Hearing Officer Kelly O'Sullivan. After hearing arguments, the parties signed a stipulation settling the matter and requested that the board enter an order requiring compliance with the stipulation and to dismiss the appeal. [66] In 2003, when CFAC made plans to restart several potlines, the DEQ required CFAC to show it could comply with the polycyclic organic matter requirements within 180 days of restarting. The plant also was required to come up with a plan to resolve their polycyclic organic matter compliance issues. The DEQ acknowledged that the EPA set polycyclic organic matter emission limits and would have a hand in establishing a compliance schedule. [67]

CFAC Potlines Superintendent and later General Manager Steve Knight kept employees informed about emissions compliance. In a Jan. 4, 2000, issue of "Smelter Notes," Knight said CFAC had complied with the state standard of 2.4 pounds fluoride emitted per ton of aluminum produced with 2.4 pounds in November and 1.9 pounds in December. [68] In March, Knight reported the best results since the company began operating under new MACT guidelines, with 1.4 pounds of fluoride averaged across all five potlines. [69] The second round of fluoride emission testing completed by mid-June reported 1.8 pounds of fluoride averaged across all five potlines. [70] The complete plant shutdown in 2001 during the West Coast Energy Crisis set back the plant's progress, as idled equipment developed maintenance problems and the plant faced all the emission problems related to restarting potlines. In March 2002, as CFAC announced plans to restart Potline 4, Pat Driscoll at DEQ's compliance division informed CFAC that it didn't need an air pollution variance to restart the pots. State regulations contained provisions recognizing difficulties faced in restarting idled pots so long as "all reasonable measures are taken to eliminate excessive emissions," he said. Elton Erp, DEQ's representative for community air quality in the Flathead Valley, said CFAC operated a perimeter monitoring station but the state wouldn't use CFAC's data because the company was reluctant to provide quality assurance data on particulate monitoring. [71] According to DEQ estimates, CFAC emitted 14,746 pounds of fluoride during the first 20 days of the restart period for Potline 4 in 2002, 9,331 pounds for the second month, 14,678 pounds for the third month, and 11,002 pounds for the fourth month. [72]

According to the EPA's Enforcement and Compliance History Online database, the "air facility system for Clean Air Act programs" at the smelter in Columbia Falls was inspected twice between 2002 and 2005 and was found to be out of compliance during four quarters in that three-year period. There were also "alleged current significant violations" and an "informal enforcement action" was taken during that time period. [73] In April 2004, CFAC exceeded the state limit of 2.6 pounds of fluoride per ton of aluminum produced by reaching 3.6 pounds. The level dropped to 1.9 pounds in May 2004. CFAC settled an enforcement action with the DEQ for the 2004 violation in April 2006. CFAC had self-reported the violation and agreed to a $56,000 fine. CFAC paid $14,000, with the rest of the fine suspended pending completion of a $56,436 baghouse project for the East Plant alumina unloader, which would reduce particulate emissions but not fluoride emissions. DEQ did not have any other enforcement actions against CFAC from Sept. 1, 2004 through March 21, 2006. [74]

The ductwork rule change

Four years after CFAC dealt with a major repair project for ductwork at its West Plant dry scrubber, plant managers began to take steps in anticipation of a similar project. CFAC Environmental Manager Steve Wright advised the Montana Air Pollution Control Advisory Council on Nov. 9, 2000, about the company's need for an air pollution variance that would allow plant personnel to bypass the dry scrubber system while undergoing scheduled maintenance. Wright said aluminum plants "are unique and different in many ways from other industries" and that "it is very difficult to shut down the process – the last time it took ten days to shut down a potline and four to six months to start up and get everything stable and in operation. Shut-downs and start-ups also cause excess emissions." The lack of redundancy in the dry scrubber system necessitated bypassing the system for maintenance or else shutting down that portion of the plant, Wright said, "which is not feasible for small projects that take four to five hours." The alternative was to "continue to follow a malfunction plan – do corrective work when a malfunction occurs and then declare that malfunction and go through the needed paperwork," Wright said. What the company wanted was a rule change that would allow them to complete small repair jobs without obtaining a variance. [75]

CFAC had used the hearing process for planned maintenance but "that is cumbersome and takes time," Wright told the council. "There should be a better way to do it." Wright estimated that 2.8 tons of fluoride would be emitted during 12 hours of scrubber outage, but the last modeling indicated that emissions in a four-hour window would not cause the plant to exceed ambient air standards. In the example discussed, only 20 pots would be off line during the repairs. The DEQ's Charles Homer noted that an air pollution variance would apply only to state rules, so an industrial facility could still be in violation of federal rules. Homer said the DEQ understood CFAC's problems, that variances moved slowly, and that a limited window was available for maintenance scheduling – generally in October and November after the growing season but before winter inversions and other adverse weather conditions. Homer also said the DEQ had concerns that a rule might allow uncontrolled emissions. Examples cited by CFAC of variances from other states were too general, Homer said. A draft variance should include time limits and allowable ambient air conditions. Homer also was concerned about whether a rule change allowing industry to bypass air pollution control equipment would be specific to the aluminum industry. Homer said the EPA had similar rules in the federal agency's Region 10 but not in Region 8, which included Montana, and he didn't know how the EPA would respond to such a rule change. Homer also said some type of economic impact should be included in further analysis of the rule change proposal. [76]

When the CFAC plant completely shut down in January 2001 during the West Coast Energy Crisis, the DEQ's Pat Driscoll sent a letter to CFAC advising the company to take advantage of the downtime to conduct preventive maintenance on its pollution control equipment. The DEQ was still developing a maintenance rule so CFAC would not need to apply for air pollution variances to make routine repairs. [77] The rule change involved significant investigation and public process. Bison Engineering of Helena issued a modeling analysis report for CFAC on Jan. 17, 2002, as part of the rule change process. The rule change would allow CFAC to temporarily bypass its dry scrubbers during routine maintenance without having to go through a lengthy variance request procedure. The rule change would apply to the 24-hour ambient air quality standards for PM-10, set at 150 micrograms of particulates less than 10 microns in diameter. [78]

According to CFAC's proposed scheduled maintenance plan, one of the plant's two dry scrubber units would be shut down entirely for half an hour while workers inserted balloon devices in the ductwork to isolate the work area. This would take place at the start and end of the seven-hour work window. Twenty reduction pots would be isolated from the dry scrubbers for the six-hour period in between while workers repaired ducting. The work would be scheduled for the fall after the growing season ended. Bison Engineering conducted extensive meteorological tests for the month of September for the modeling analysis. Its measurement of wind speed and direction monthly from January 1997 through March 2001 showed winds predominantly blew from the southwest across the smelter. Modeling results showed PM-10 emissions as high as 124.8 micrograms, below the 150 microgram standard. The model also showed that during the entire seven-hour window, work in the West Plant would release 532.2 pounds of PM-10 emissions, while work in the East Plant would release 700.2 pounds. [79]

The Montana Board of Environmental Review scheduled a public hearing on May 23, 2002, to listen to CFAC's request for the rule change. The proposed rule contained the following conditions: 1) maintenance must take place during September, beginning between 9 a.m. and noon and ending by 8 p.m. the same day; 2) uncontrolled PM-10 emissions were not to exceed normal emission levels by more than 700 pounds in a 24-hour period; 3) the company would submit an approved maintenance plan; and 4) the company would provide public notice of the scheduled repair in a local newspaper and on the company website. The last time a variance was issued by the state, the board had specified that the maintenance be done after the growing season but prior to the onset of winter inversions at a time when winds were blowing at least 5.6 miles per hour. Adverse weather conditions, however, had prevented plant personnel from completing the maintenance work. The company did not request another variance to complete the maintenance work because the plant shut down during the West Coast Energy Crisis. The new rule contained similar conditions to past variances. The board recognized that it was theoretically possible to install redundant air pollution control equipment and ductwork so it was not necessary to entirely bypass the air pollution control equipment for maintenance, but the cost of such redundant equipment would be a significant capital expenditure. [80]

The Montana Board of Environmental Review published a notice adopting the rule change on Aug. 15, 2002, that included a number of comments by the EPA's Region 8 office. The EPA noted that "scheduled maintenance is a predictable event which can be scheduled at the discretion of the operator… Consequently, excess emissions during periods of scheduled maintenance should be treated as a violation unless a source can demonstrate that such emissions could not have been avoided." The Board of Environmental Review responded that "the aluminum process is unique in that the process does not include periodic shutdowns" because restarting potlines was expensive and lengthy. The board noted that "it often takes 4-6 months after startup before processes within the aluminum reduction cells stabilize and aluminum is reliably produced." The board also said CFAC had completed a great deal of maintenance work on its East Plant dry scrubber system when it was shut down during the West Coast Energy Crisis and planned to do similar work for its West Plant dry scrubber system in 2002. [81]

The EPA noted that the exception rule allowed by the Montana Board of Environmental Review would be a violation of the federal Clean Air Act, but the board responded that "use of the rule will actually minimize emissions compared to emissions during startup if the facility is forced to shut down to perform the maintenance activities." The EPA also noted that the exception rule could be interpreted to excuse CFAC from meeting the new MACT standards, and that state rules and regulations could not be less stringent than federal rules. The board responded that the exception rule would only apply in limited time periods. The EPA also noted that modeling was conducted only for the month of September over a period of three years, which was inadequate. The board responded that this type of maintenance for the dry scrubbers could only be conducted during the month of September, and that CFAC could not conduct this type of maintenance when adverse weather conditions existed. The EPA also stated that modeling for the plant did not take into account the Columbia Falls nonattainment area for PM-10 and that "any additional emissions added to this air shed, as predicted by this modeling, could jeopardize attainment and maintenance" of acceptable levels for Columbia Falls. The board responded that "the CFAC plant is located north of Columbia Falls, is situated over a substantial hill from town, and is not in the same air shed as the town. Therefore, emissions from the CFAC plant have never been considered to have a significant impact on the Columbia Falls" nonattainment plan. [82]

On Oct. 29, 2003, the EPA published in the Federal Register its proposal to disapprove of the DEQ's plan for a rule change. The DEQ had submitted the proposed plan to the EPA on Jan. 16. EPA said "any provision that allows for an automatic exemption for excess emissions is prohibited" and that "the appropriate mechanism for excusing excess emissions in this situation is through the exercise of enforcement discretion." The EPA said "scheduled maintenance is a predictable event which can be scheduled at the discretion of the operator, and which can therefore be made to coincide with maintenance on production equipment, or other source shutdowns" and "consequently, excess emissions during periods of scheduled maintenance should be treated as a violation unless the source can demonstrate that such emissions could not have been avoided through better scheduling for maintenance or through better operation and maintenance practices." The EPA rejected the state's claim that "the aluminum process is unique" because shut downs and start ups were lengthy and expensive or because the plant must bypass the dry scrubbers in order to do the maintenance work. "We are not convinced that the CFAC aluminum process is so unique, or that redundant control technology could not be added," the EPA said. "We are not aware of other aluminum facilities that have asked for an exemption to emission limits for scheduled maintenance." [83]

The EPA also was concerned about impacts on the Columbia Falls PM-10 nonattainment area. "CFAC is only about one mile from the city of Columbia Falls," the EPA said. "The state has not demonstrated that this plan revision will not interfere with the attainment plan for the Columbia Falls PM-10 nonattainment area." The EPA also found fault with modeling conducted by CFAC and used by the state in its proposed plan. The model used "allowable emissions" rather than "normal operating emissions," neglected other sources of emissions in the air shed, used meteorological data collected over three years rather than the five years required by the EPA, and used a monitoring station near the plant to determine ambient concentrations of PM-10 emissions rather than a monitoring station in Columbia Falls. The EPA also said it was concerned about how the proposed plan would impact MACT standards, which did not provide for exempting excess emissions during a maintenance event. “Any excess emissions have to be reported and enforcement discretion used in determining what, if any, penalty is appropriate for the event,” the EPA said. [84]

On Jan. 28, 2005, the Montana Board of Environmental Review took a second look at the proposed rule change which would allow CFAC to bypass its dry scrubber during routine scheduled maintenance. The EPA had proposed disapproving the rule change because it “could be interpreted to alter the requirements of the delegated MACT standard” and that adopting the rule change would create a conflict with the state’s requirements – one set in the MACT standards and another in its State Implementation Plan rule, with the result of confusion for CFAC and the public over which rule applied. The board considered and approved revising the language in the rule change by specifying that enforcement prohibition did not apply to enforcement of the MACT standard. The language change, however, did not address all of the EPA’s concerns. [85] “Effective Feb. 24, CFAC can bypass air pollution control equipment for routine maintenance if it doesn’t violate the MACT standard,” DEQ Section Chief Charles Homer told media. He noted that the EPA also had to approve the rule change. [86]

The DEQ posted an explanation for the rule change on its website on Aug. 7, 2005. CFAC planned to bypass its East Plant dry scrubber for scheduled maintenance on Sept. 13, 2005. The DEQ’s online document provided an explanation of the need, description of contaminants, description of procedures in the maintenance project, description of procedures to minimize PM-10 emissions, permit requirement citations and a photo showing ductwork needing repair. The document also provided three tables showing historical data on fluoride emissions during the Potline 4 restart in 2002, predicted data on emissions during the upcoming maintenance event, and normal emissions from Potline 5 compared to emissions predicted during the upcoming maintenance event. CFAC wanted to replace or repair two 90-degree elbows in the 52-inch diameter bleed air ductwork that were damaged by erosion from particulates in pot gases. CFAC workers already had patched holes in the ductwork. [87]

To complete the work, according to CFAC personnel, the East Plant dry scrubber needed to be shut down for about four hours. The alternative was to shut down the entire Potline 5, but restarting Potline 5 could cause up to 25 tons of fluoride to be emitted, while shutting down the dry scrubber for four hours would cause 0.38 tons of fluoride to be emitted. Shutting down Potline 5 would also create a hardship for CFAC by upsetting production schedules and possibly causing CFAC to be in default with its tolling customers. A shutdown of Potline 5 also could cause long lasting problems in the reduction cells, leading to unreliable production. Both raw material purchases and aluminum sales would have to be rescheduled, and restarting Potline 5 could cost CFAC about $1.5 million in energy and other costs. DEQ said that for these reasons, "the shutdown and restart of the facility does not yield any public health or safety benefits, and actually causes more emissions to the environment." Pot gases containing gaseous hydrogen fluoride, particulate fluoride, polycyclic organic material and PM-10 particulates would be emitted during the four-hour maintenance event. To reduce down time on the dry scrubber, CFAC maintenance personnel would have to pre-fabricate the replacement components and get all men and tools in position to accomplish the project quickly. To reduce emissions, there would be no metal tapping, no pin pulling, no pot raking and no cryolite tapping at affected reduction pots during the maintenance period. [88]

The final years

As CFAC struggled to keep its smelter operating while facing high power and raw material prices and low metal prices, plant crews installed a sow casting line in fall 2006 to lower casting costs. The Montana Department of Environmental Quality determined that the project was a "de minimis" change and did not require an additional air pollution control permit. [89] The plant fired up more potlines in 2007, and one of CFAC's neighbors noticed the emissions that resulted from startup operations. Ron and Pat Wood, who had lived near the smelter since about 1988, described the incident in an April 28, 2015, letter to the EPA in support of putting the smelter site on the federal Superfund program's National Priorities List for cleanup. The Woods said that in September 2007, they noticed an "extended release of some sort of vaporous effluent." The Woods said "this had happened periodically in the past," but "that particular event was worrisome because of the length and density of the release." They said they called CFAC to see what was going on but were "brushed aside with the explanation that they were changing the scrubbers (whatever that means)." [90]

CFAC personnel bypassed the East Plant dry scrubber system again on Feb. 17, 2009. The 20-minute interruption of normal emissions control was made in order to install a blind flange in the scrubber ductwork as the plant began to curtail operations. The blind flange was intended to isolate Potroom 7 and prevent backflow of uncontrolled emissions into Potroom 9. CFAC reported what it had done to the DEQ in a Facility Upset Report on March 4, 2009. "This event was not a malfunction," CFAC said in the report. "Procedures in CFAC's Startup, Shutdown and Malfunction Plan were followed." The DEQ responded by sending a warning letter on March 12, 2009, informing CFAC that the procedure had violated Montana's Clean Air Act according to the requirements of CFAC's air quality permit. [91] By July 2009, CFAC was operating only Potroom 9. During that month, the plant emitted 2.9 pounds of fluoride per ton of aluminum produced, exceeding the state limit of 2.6 pounds. CFAC was found in violation of its air quality permit and paid a $4,600 fine. CFAC protested that it tried to do the best it could under trying economic conditions and asked for more of a reduction in the fine based on good faith effort, but the DEQ denied the request. [92] The violation was based on fluoride emissions per ton of aluminum produced, which did not take into account that the plant was only operating at 10% of capacity.

CFAC Environmental Manager Steve Wright responded to the DEQ on Sept. 16, 2009, with a three-page letter explaining the circumstances that led to the July air pollution violation. “As you are aware, CFAC has been operating under the most severe economic conditions the U.S. aluminum industry has seen in decades,” Wright wrote. The plant had cut back to only one pot room on Feb. 20 following orders from Glencore on Feb. 13. The hope was that keeping one potroom operating would simplify restart operations if the aluminum industry picked up again. On Feb. 13, Glencore began the process to order more petroleum coke and coal tar pitch so the carbon paste plant could begin to process anode briquettes. It typically took about 90 days for an anode briquette on top of a Soderberg anode to melt, harden and move down to the face of the anode inside the pot. CFAC’s inventories of coke and pitch were very low by that time because the plant had been planning to shut down entirely on Feb. 20. “CFAC operated with a chronic shortage of anode briquettes throughout the spring of 2009,” Wright wrote. As some raw materials arrived, CFAC tried to make more briquettes, but that couldn’t be done in a timely manner. “There was a two week period in March 2009 when no briquettes were fed to the pots because CFAC had run out of raw materials,” he wrote. [93]

Wright told the DEQ that CFAC located a surplus quantity of briquettes at a closed aluminum reduction plant in the Pacific Northwest that also used Soderberg-type reduction pots. “CFAC did not anticipate any problems using the surplus briquettes,” Wright wrote. CFAC began to use the surplus briquettes with briquettes it had made at CFAC starting in March 2009, and used the surplus briquettes alone for two weeks in April while it awaited a delivery of raw materials. CFAC then used a mixture of both types of briquettes until May 2009. The pots in Potroom 9 “went into an upset condition” in June and July, about the time the carbon material from the surplus briquettes reached the anode face and the period of no briquettes at all reached the anode face. “Evidently, the variation in the briquette formulations (the surplus briquettes versus CFAC briquettes) and the lack of briquette additions for short periods of time caused the anodes to perform very poorly,” Wright wrote. In late June and into July, the bottom of the anodes developed long spikes that caused short circuits inside the reduction pots, making the pots excessively heat up. The additional heat weakened and melted the bath crust, allowing more emissions to escape into the potroom and out the rooftop vents. Furthermore, the pots had to be opened up so workers could remove the spikes. Otherwise, the spikes would continue to grow, and the pot would continue to overheat. Lifting up the anodes to remove the spikes allowed even more emissions to fill the potrooms and escape through the rooftop vents. [94]

Smelter workers also found that anodes had de-laminated into layers, with pieces breaking off, Wright told the DEQ. Plant personnel figured this was caused by the differences in the coefficient of expansion between the different briquette layers. To correct the problem, CFAC had to open the pots and remove large pieces of the anode. Each time a pot was opened up, more emissions took place and escaped through the rooftop vents. Furthermore, the pinhole paste used to seal the steel pins connecting the carbon anode to the overhead buss oxidized at the anode face and fell into the pot. The result was that emissions escaped into the potroom each time a pin puller removed an anode pin. "This phenomenon had not been seen before, and CFAC believes it was the result of chemical reactivity differences in the mixtures of briquettes used in the previous months," Wright wrote. The frequency of anode problems peaked in July, causing elevated fluoride emissions. Wright also noted that hot July weather contributed to the problems. Aluminum production and efficiencies were impacted by the anode problems. Aluminum production per hour fell from 2.1 to 2.2 tons in March through August to 1.9 tons in July, electrical current efficiency fell from 86.19% to 89.15% in March through August to 79.54% in July, and aluminum production per month fell from 1,510 tons to 1,621 in March through August to 1,399 in July. "Rather than producing aluminum metal, a disproportionate amount of the electricity consumed in July caused resistance heating of the anode and did not produce metal," Wright wrote. Lost aluminum metal production for July was worth about $260,102, based on the marginal selling price for aluminum, and overtime pay for workers dealing with the unexpected problems totaled $22,500 in July. [95]

As the aluminum smelter in Columbia Falls wound down operations in its final years, fluoride emissions for the plant as a whole declined because the number of reduction pots in operation also declined. But CFAC got into trouble with state environmental regulators because the fluoride emission standard was based on pounds of fluoride released per ton of aluminum produced – as total production declined, so did the actual amount of fluoride emissions. Major problems staff faced in the plant's final years were the number of restarts, which by their nature caused more pollutants to be emitted, and worn out equipment, especially pot gas ductwork that was weakened over the decades by the steady grinding of particulates emitted by reduction pots against the ductwork walls. By 2009, when the smelter was only running at 10% of capacity, with one potroom and 60 pots, it still ran into violations because of bad raw materials creating faulty anodes. As a result, pots ran too hot and needed to be opened up for repairs. Rather than just flip a switch and shut down all the potlines, personnel struggled to find ways to keep the plant running, which resulted in sick pots and continuing emission violations. Once the potlines finally went cold, fluoride and polycyclic organic matter emissions halted altogether. Winds blew small amounts around the surrounding forest land, but all aerial pollutants eventually settled on the ground and washed into the soil. The remaining threat to the environment was hidden underground in decades-old on-site landfills – hazardous chemicals contained within spent potliner.

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