Chapter 58

Smelter wastes and cleanups

The Columbia Falls Aluminum Co. plant site, like other heavy industrial sites, was impacted by the typical variety of hazardous chemicals used by maintenance and production personnel or created as a result of process operations. The large number of vehicles necessitated a maintenance garage and fuel tanks, some located underground, which over the years generated daily waste or spills that contained solvents, lubricants, diesel fuel and gasoline. The vast array of mechanical processing equipment – from crushers, shakers and feed belts to pollution-control equipment, casting equipment and overhead cranes – likewise required maintenance crews and repair facilities that generated similar waste over the years. The 600 reduction pots required periodic rebuilds over their lifespan. Equipment maintenance and process operations also were responsible for producing heavy metals. The large transformers and other electrical equipment were a source for polychlorinated biphenyls (PCBs). Asbestos was used to insulate exhaust flues and steam pipes, as well as a binder in roofing material and flooring tile. [1]

In addition to the typical hazardous chemicals found at many industrial sites were the chemicals associated with the aluminum smelting process – including coal, coke and coal tar pitch used to make carbon paste briquettes and a source of emissions from open-topped Soderberg anodes; fluoride compounds used to make bath and emitted by reduction pots in pot gases or fugitive emissions in potrooms and by crushing and handling frozen bath; dross produced by casting furnaces and operations; and spent potliner created in cathode pot bottoms. Spent potliner at aluminum smelters consisted of refractory brick, cathode electrodes and carbon paste which contained various hazardous compounds created after years of pot use, including ammonia and cyanide. [2] The Environmental Protection Agency first listed spent potliner as hazardous in 1980 under the name code K088 because it contained high concentrations of cyanide. By the late 1990s, an estimated 100,000 to 125,000 tons of spent potliner were produced in the U.S. every day. [3]

Unlike the various petroleum-based chemicals and heavy metals typically found at industrial sites, cyanide compounds were soluble in water. Cyanide compounds formed in the potliner when atmospheric nitrogen entered the pot by lancing to manually extinguish an anode effect, by automatic anode-effect suppressors or by natural

convection, and the nitrogen reacted with other substances in the cathode. In one reaction, sodium from the bath reacted with the carbon liner and nitrogen from the air to create sodium cyanide. Aluminum carbide, aluminum nitride and sodium fluoride could also be created. [4] Whereas many hazardous chemicals found at industrial sites were carcinogens, cyanide was highly toxic – it was an inhibitor of the enzyme cytochrome c oxidase, which could disrupt human cells from producing adenosine triphosphate (ATP), the cell's form of energy. Tissues that depended on aerobic respiration, including the central nervous system and the heart, could die of histotoxic hypoxia when exposed to cyanide. [5]

On Jan. 10, 2025, the Environmental Protection Agency's Region 8 office released to the public its Record of Decision for the cleanup of the Columbia Falls Aluminum Co. Superfund site in Montana. A number of comments received for the ROD referred to cleanup actions at other Pacific Northwest aluminum smelter sites. The EPA summarized these comparisons in general and in detail. "Ongoing and completed cleanups at former aluminum reduction plants differ for each site, as cleanup depends on the nature and extent of contamination, the condition of the remaining wastes, and the environmental setting. This response focuses on remediation of nine former aluminum smelter sites in the northwestern U.S. These are the most relevant to the CFAC site. Seven of these sites are in Washington and two are in Oregon. Several of these sites are under the purview of the Washington Department of Ecology under its Model Toxics Control Act, which is a state RCRA program. Consequently, the criteria for evaluating cleanup alternatives are somewhat different from the nine criteria used in Superfund. For example, Washington allows a "substantial and disproportionate" analysis to compare alternatives. This allows costs for alternatives to be compared to the incremental degree of protection afforded by each alternative." [6]

According to the Washington Department of Ecology's 1985 figures for wastes generated by the seven aluminum smelters in that state, Alcoa's Vancouver smelter annually generated 3,000 tons of spent potliner, 56,400 pounds of electro-melt dust and 132,000 pounds of stub-cleaning catch; Alcoa's Wenatchee smelter annually generated 72,000 pounds of rod-blast dust, 36,000 pounds of electro-melt dust and no spent potliner; Comalco's Goldendale smelter annually generated 525,000 gallons of scrubber sludge; Kaiser's Tacoma smelter generated about 5,000 tons of spent potliner, 720,000 gallons of spent potliner leachate and 70 tons of duct dust; Kaiser's Mead smelter in Spokane annually generated about 4,300 tons of spent potliner, 70 tons of electro-melt dust, 70 tons of copper dust, 1,000 pounds of coal tar oil and 14,000 pounds of solvents and thinners; and Reynolds' Longview smelter generated 25,800 tons of black mud. The

figures, which were self-reported, not comprehensive and unavailable for Alcoa's Intalco smelter that year, provide a snapshot of the amounts and types of hazardous substances produced at an aluminum smelter. [7] Spent potliner was often the focus of cleanup projects at former aluminum smelter sites, where it often was dumped over the decades in unlined landfills or surface piles. Cyanide and other hazardous contaminants typically leached out of spent potliner, drained into the underlying soil and rock and entered groundwater.

The Vancouver cleanup

The aluminum plant built by Alcoa in 1939 on the Columbia River three miles from Vancouver, Wash., was the first aluminum smelter in the Pacific Northwest. By 1950, the smelter had five 50,000-amp potlines with a capacity of producing 85,000 tons of aluminum per year and employed 1,100 workers. [8] Employment peaked at 1,200 workers in the 1970s. The smelter closed down in June 1986 during a nationwide labor dispute. Private investors formed Vanalco to purchase the plant from Alcoa in October 1986, and the plant was back in operation in June 1987. High power prices during the West Coast Energy Crisis forced the plant to close in June 2000, and 600 jobs were lost. Vanalco filed for Chapter 11 bankruptcy protection in January 2001. On March 25, 2002, Glencore International offered in federal bankruptcy court to buy the 115,000 ton-per-year Vanalco smelter for $24.25 million. The smelter facility operated under the name Evergreen Aluminum. [9]

In 1986, the Washington Department of Ecology ordered a cleanup investigation and feasibility study for spent potliner at the Vancouver smelter. This was the first in a long string of cleanup actions at the site. Under the Department of Ecology between 1988 and 2011, Alcoa or Evergreen Aluminum cleaned up PCB contamination in and around the Rod Mill, the Northeast Landfill, the East Landfill and along the banks of the Columbia River. The companies also cleaned up a spent potliner dump, a process-water settling lagoon and a waste oil dump near the Extrusion Mill. Once demolition started, Evergreen Aluminum removed 62,500 tons of contaminated soil and industrial waste from the smelter site. [10]

The EPA added the Vancouver smelter site to the federal Superfund's National Priorities List in 1990. According to a May 1999 EPA report, spent potliner containing fluoride and cyanide was dumped outside the plant for decades, contaminating soil and groundwater. The EPA worked with Alcoa to remove 50,000 tons of spent potliner for transport and burial at a certified landfill. [11] Hazardous wastes had been stored in waste

piles across the site which contained petroleum hydrocarbons, polychlorinated biphenyls (PCBs), cyanide, fluoride, trichloroethylene, low level organic chemicals and metals. In 1997, Clark County officials notified the Department of Ecology about PCBs discovered in the Columbia River – two years after Alcoa had removed PCB-contaminated soil and concrete from the former Rod Mill building. Alcoa spent $34 million on a cleanup of the PCBs. At one point in 2007, warning signs were put up in eight languages telling people about contaminated clams in the Columbia River. A consent decree filed in court in 2009 stated that Alcoa and the Department of Ecology would continue to negotiate on the cleanup of contaminated groundwater found beneath the East Landfill. [12]

By the end of February 2003, there was no word on a future restart at the Evergreen Aluminum smelter. “My understanding is that the owners (Glencore) acquired it at a low price, so they don’t have a lot of money invested in the plant, and for them it might be something to have in reserve so if the industry picks up, they could produce,” Terry Morlan, an economic analysis for the Northwest Power and Conservation Council in Portland, suggested. John White, president of The J.D. White Co., an environmental firm in Vancouver, had conducted a draft environmental impact statement for the nearby 1,100-acre Columbia Gateway property. “The issue, if we are talking redevelopment, is the cost of demolition of all those facilities,” White said. The debris would have to go to specialized disposal facilities, which would be a very expensive. “Any time you are talking about the kind of toxicity they have, it is not a simple process,” White said. [13]

In July 2003, the Department of Ecology published amendments to a groundwater monitoring plan for the Vancouver smelter site. The state identified five cleanup sites on the eastern side of the complex, including the spent potliner dump, the Rod Mill, the East Landfill, the North Landfill and the North 2 Landfill. The amendments ended monitoring at the Rod Mill and changed the frequency of monitoring at the spent potliner site. Previous studies at the complex had found cyanide, fluoride, trichloroethylene and trichloroethylene-degradation products in the groundwater at several sites, and cyanide, fluoride, polynuclear aromatic hydrocarbons, trichloroethylene, PCBs and total petroleum hydrocarbons in the soils at several of the sites. A total of 75 monitoring wells would be abandoned, and a new network would be established for the five sites with 41 monitoring wells, of which 22 would be new. [14]

By September 2005, the Port of Vancouver was showing interest in acquiring the two sites owned by Alcoa and Evergreen Aluminum. The 100-acre Alcoa property had been a federal Superfund site. An underground plume of cyanide discovered heading toward

the Columbia River in 1990 was cleaned up by 1996, and the EPA said the site was safe for redevelopment. Alcoa's 100 acres were assessed at $4.5 million after they were cleaned up. Glencore's land had an assessed value of $5.5 million. [15] The site was transferred to the Port of Vancouver in 2009. Complete demolition and site cleanup was completed in March 2010, but more work remained. The Department of Ecology and Alcoa finalized a supplemental cleanup action plan in 2011 that included cleanup of contaminated groundwater beneath the East Landfill. [16] The Port of Vancouver closed the deal on the Evergreen property in January 2009 and on the adjacent land owned by Alcoa in March 2009 to complete the 218-acre purchase. By that time, both companies had completed their cleanup of contamination at the sites and received approval from the Department of Ecology to use the land for other industrial purposes. Environmental standards attached to the land included monitoring by the Port of Vancouver. The Terminal 5 site, with maritime cargo space, would be connected to the West Vancouver Rail Access project, accessing BNSF Railway and Union Pacific tracks. At full build-out, Terminal 5 would provide 1,000 full-time industrial and marine jobs. [17]

On Jan. 10, 2025, the EPA Region 8 office released its record of decision for the cleanup at the CFAC Superfund site. One commenter to the ROD noted that the Vancouver smelter site was along the Columbia River and that cleanup activities included Alcoa completed dredging PCB-contaminated sediments from the Columbia River at the end of January 2009. Smelter demolition and final removal of contaminated soils from the site was completed in March 2010…. The site's long-term remedy included excavating and disposing of 50,000 tons of spent potliner and reclaimed alumina. If removal 50,000 tons of spent pot liners were possible here, what basis is there for assuming it is not possible at CFAC?" [18]

The EPA Region 8 office summarized cleanup operations through 2024 in the ROD for the Vancouver site. "The Alcoa aluminum smelter operated from 1940 to 1985. Spent potline was transported offsite for recycling until 1973. From 1973 until 1981, operators piled 50,000 tons of spent potliner on the ground outside the smelter. The spent potliner was excavated and hauled to the Arlington, Ore. licensed RCRA hazardous waste-disposal facility from 1992 to 1996 under Cleanup Action Plan… These were piles of spent potliner stored above ground. In contrast, spent potliner at the [CFAC] site – in what would eventually become the West Landfill – was buried in a former gravel pit and is in seasonal contact with groundwater. As the [CFAC] Proposed Plan notes, buried spent potliner in contact with water can produce explosive gases, which is one of several reasons why excavation of this material was not selected for the [CFAC] remedy. The Vancouver site was placed on the National Priorities List in 1990 and was delisted

(after cleanup) in 1996. However, contamination remains, which is now under the purview of the Washington Department of Ecology." The EPA also noted that the commenter to the CFAC record of decision was correct that "sediments contaminated with PCBs were removed from the adjacent Columbia River in 2009. The remedy also included consolidation of contaminated soil into an existing landfill and capping of that landfill as described in Periodic Review Report… similar to the Selected Remedy for the CFAC site." [19]

The Longview cleanup

The aluminum plant on the Columbia River in Longview, Wash., was the second aluminum plant built in the Pacific Northwest. Reynolds began operating the smelter in late 1941 and shut it down during the West Coast Energy Crisis because of high power prices. In 2000, Alcoa purchased the Reynolds Metals Company as a wholly-owned subsidiary. To comply with anti-trust requirements associated with the transaction, Reynolds was required to divest itself of the smelter it owned in Longview. Reynolds sold the plant to McCook Metals, a subsidiary of Michigan Avenue Partners, in December 2000, and McCook operated the plant under the name Longview Aluminum. Reynolds entered into a ground lease with Longview Aluminum, so Alcoa, which owned Reynolds, would continue to own the land. McCook Metals LLC of Chicago, the second largest aluminum plate manufacturer in the U.S., acquired the Longview smelter facilities in 2001, but McCook filed for Chapter 11 bankruptcy protection on Aug. 6, 2001, after General Electric Capital Corp. filed suit against McCook seeking repayment on a $41 million loan. [20] Development Services Inc., which took over operations for the bankruptcy as the trustee of the estate, filed for bankruptcy in March 2003, and the plant permanently closed. The smelter in Longview hadn't run since it closed during the West Coast Energy Crisis. [21]

Bill Brandt, the bankruptcy trustee for Longview Aluminum, reported in January 2004 that a cleanup of the plant would cost from $80 million to $100 million. He based his opinion on a site study by an environmental consulting firm and the cost at similar plants. Alcoa, which acquired the plant in a merger with Reynolds, had retained ownership of the plant site after the facility was sold to successor owners in order to guarantee the site would be cleaned up, an Alcoa spokesperson told local media. Spent potliner was one of the cleanup concerns at Longview because it could contain three dangerous polyaromatic hydrocarbons as well as high levels of fluoride and cyanide. Spent potliner had become a federally regulated waste in the past 15 years and could no longer be deposited on the plant site. A big part of the estimated cleanup cost would be

disposal of hazardous materials in special offsite landfills. Groundwater beneath a former spent potliner disposal site may have been contaminated, the Washington Department of Ecology told local media. Other cleanup concerns included fuel and oil storage tanks, a general industrial landfill and a floor-sweepings landfill. In addition, Reynolds had operated a cryolite recovery facility in Longview that took spent potliner from aluminum smelters around the Pacific Northwest and extracted cryolite. The process produced a black carbon liquid that accumulated over time in several black mud ponds. Another pond made of white mud contained lime. The material in both ponds was considered hazardous waste by Alcoa. [22]

Beginning April 20, 2004, Dovebid Inc. began auctioning equipment at the bankrupt Longview smelter. Some equipment went to scrap, other pieces went to fabrication shops up and down the West Coast. Bill Brandt hoped to raise $5 million at the auction after his bankruptcy company contacted nearly every metals company and was unable to find a buyer for the plant. Longview Metal's debt to unsecured creditors was about $100 million. Some bidders reportedly were looking at the silos and ship-unloading facilities on the plant's docks. [23] Three days later, flat-bed trucks were seen hauling equipment away from the plant. A British Columbia company that made sawmill equipment purchased some of the machine tools. [24] In July, it was announced that Nootka Holdings Inc. of British Columbia had offered $2.5 million to take over Longview Aluminum's assets, help clean up the site and to pay off back county taxes. The proposal included taking over the remaining 96 years on a long-term lease from Alcoa and purchasing the smelter's pier, crane and other assets. Three other unnamed companies had also expressed interest in acquiring the site. Longview Aluminum's creditors included the Bonneville Power Administration and workers pension funds. Cowlitz County claimed earlier it was owed about $1.6 million in back taxes. [25] The federal judge overseeing the bankruptcy proceedings said he would give Alcoa and Nootka Holdings only 10 days to reach an agreement so the Canadian company could take over the 500-acre site and begin importing lime. The deal was being held up by negotiations over site cleanup and who had the right to sell aluminum remaining at the site. Nootka had put up $250,000 in earnest money on a $2.5 million offer. [26]

Nootka, operating as Chinook Ventures Inc., entered into a long-term ground lease with Reynolds on Nov. 30, 2004. Reynolds then assigned its obligations and interests in the lease to Northwest Alloys Inc. on Sept. 30, 2005. Chinook used the site as a shipping terminal for the import, handling and export of dry bulk materials, including alumina, coal, green petroleum coke, cement, fly ash, slag and other materials. The alumina was shipped to the Alcoa smelter in Wenatchee, Wash. Chinook was the sole operator of the

site until January 2011 when it sold the plant's assets to Millennium Bulk Terminals-Longview. Reynolds hired Envirocon Inc. of Missoula, Mont., to demolish the cryolite recovery plant in May 2004. The work included recycling about 800 tons of metals and 150 tons of concrete, hauling offsite 161 tons of construction debris and 132 tons of brick-refractory as nonhazardous waste, and disposing of 850 tons of underflow solids as dangerous waste to a landfill in Arlington, Ore. Forty potroom transformers were sold by the bankruptcy trustee to Calbag Metals Co., of Portland, Ore., and the transformer metals and oil were recycled. Chinook hired Envirocon to begin a plant-wide demolition and cleanup project in early 2005 for the North Plant and South Plant potrooms under a work plan approved by the Department of Ecology. The North Plant consisted of six potrooms built in the 1960s, and the potlines buss work was made of aluminum. The South Plant consisted of three potrooms built during World War II, and the buss work was made of copper. Potroom equipment was removed, including reduction pot superstructures, anodes, cathodes, buss work and other hardware. Metals including copper, aluminum and steel were recycled. About 24,324 tons of anode carbon was stored, crushed and sold for use in the steel industry. [27]

Envirocon crews cleaned pot rooms and courtyards; fume control equipment, including the electrostatic precipitators; equipment in the two cast houses; the mixer side of the carbon plant; the maintenance buildings, pot-digging building, pin and channel building, pot-relining building and compressor building; the unloading tower and South Plant alumina handling system; wastewater and stormwater systems and the wastewater treatment plant; and the cable plant's cast house and warehouse. About 26,000 tons of spent potliner was removed from cathodes in the pot-digging building. The potrooms were washed from the roof line down and solids in the wash water were collected in the stormwater settlement pond and disposed of offsite. Contaminated soils were removed from the former scrap yard and hauled away. When the potrooms were empty and clean, Chinook set up a crusher to crush anode carbon. [28]

On June 15, 2007, Chinook and Northwest Alloys signed an agreement with the Department of Ecology requiring the parties to complete a remedial investigation and feasibility study for a cleanup project. The study identified 11 areas of potential concern. In 2008, the Department of Ecology approved proposed remedial actions for two areas of concern – a fuel island and ditches around the cryolite recovery plant. All told, Chinook recycled 3,568 tons of copper, 7,578 tons of aluminum and 38,440 tons of steel. The company removed 24,324 tons of anode carbon, 29,270 tons of hazardous waste and 9,688 tons of non-hazardous waste. After Millennium took over the site in 2011, it disposed of 63 tons of cleanup debris, 60 tons of wood waste, 15 tons of coal tar pitch-

impacted debris; five tons of underflow solids, 1.8 million gallons of thin stillage and 775,000 gallons of stormwater from the outdoor coke storage area. [29]

In November 2008, Chinook owner Barry Oliver said cleanup of the Longview smelter site would take three more years and cost about $65 million. He noted that Chinook knew what it was getting into when it bought the assets at the former smelter in 2004 and was familiar with industrial cleanup projects. Workers had been cleaning and dismantling buildings for the past four years, and the above-ground cleanup was expected to be completed by December 2008. In the first year, 26,000 tons of hazardous materials located above ground were removed. Much of that was spent potliner that contained polyaromatic hydrocarbons and elevated levels of fluoride and cyanide. Reynolds had dumped spent potliner on a field east of the smelter until the Department of Ecology ordered Reynolds to remove the piles in the 1990s. Some of that potliner still remained, Oliver said. The below-ground work would include removing contaminated soil, black mud ponds, an industrial landfill and a floor-sweepings landfill. At one time, the plant had 3 million tons of black mud, but Reynolds had removed about 2.5 million tons of the hazardous material. [30]

In June 2011, the Department of Ecology reported that Alcoa had completed a cleanup plan for the Longview smelter. Over the years, the Department of Ecology had fined Chinook nearly $200,000 for air and water quality violations and for operating non-permitted equipment. In 2011, Chinook sold the facility for $10.9 million to Millennium Bulk Terminals, a joint venture between Australia-based Ambre Energy and St. Louis-based Arch Coal which planned to build a coal offloading facility at the site. If Millennium failed to clean up the plant, Alcoa would be responsible because it still owned the land. Officials at the Department of Ecology said the cleanup would be a huge undertaking and would cost tens of millions of dollars. [31]

On Sept. 14, 2018, the official comment period ended for a draft cleanup plan for the Longview plant site developed by the Washington Department of Ecology. The revised plan was completed in August 2018. The department considered six alternative cleanup plans and chose Alternative 4. In its evaluation, the department found that the Alternative 4 provided greater benefits than Alternatives 1, 2 and 3 and at $74 million was significantly less costly than Alternative 6 at $344 million. Benefits were evaluated according to levels of protectiveness for human health and the environment, levels of permanence in terms of reducing toxicity, mobility or volume of hazardous substances, levels of effectiveness over the long term in terms of reliability, restoration and magnitude of residual risk, levels of short-term risk during the construction of remedial

actions, levels of technical and administrative implementation, and consideration of public concerns. Alternative 4 called for localized removal and off-site disposal of some hazardous materials, excavation and consolidation of some hazardous materials, low-permeability capping of hazardous materials left on site, natural attenuation of some contaminated groundwater by geo-chemical processes, and institutional controls including long-term monitoring. One of the recommendations called for constructing a 350-foot long and a 725-foot long trench perpendicular to the flow of groundwater contaminated with fluoride and back-filling the trench with reactive materials consisting of calcite, or limestone, and apatite, or bone meal. Alternative 6, the most expensive, called for aggressive removal and off-site disposal of hazardous materials along with natural attenuation of some contaminated groundwater by geo-chemical processes and institutional controls including long-term monitoring. [32]

A preliminary schedule called for cleanup construction work starting as late as 2020. The site was zoned for industrial uses and was expected to be put back to work in industry. Other than long-term monitoring, there were no additional cleanup plans for the black mud pond area, where wastewater from a fluoride and aluminum reclaiming process was dumped. The wastewater contained residual carbon, which made it black in color. The 33-acre black mud pond was formally closed and covered with a low permeability cap in 1992. Lime was processed at the site to produce sodium hydroxide solution for the cryolite recovery plant. The spent lime was called white mud and was dumped at a location in the east plant that was closed in the 1970s. The three on-site landfills ceased to be used in the 1980s. The primary chemicals of concern at the plant were fluoride and polycyclical aromatic hydrocarbons. Free cyanide and fluoride had been detected where groundwater discharged into ditches at above applicable screening levels. Average concentrations of PAHs and PCBs in sediments at the plant site were below the applicable risk-based threshold concentrations for bioaccumulative chemicals. [33]

On Jan. 10, 2025, the EPA Region 8 office published its record of decision for the cleanup of the CFAC Superfund site. It summarized cleanup efforts through 2024. “The Reynolds Aluminum smelter operated from 1941 to 2001, and Reynolds also operated a cryolite recovery plant to recycle spent potliner from their smelter and other smelters in the Pacific Northwest. No spent potliner was stored or buried onsite, but residual carbon waste generated by the recovery process was disposed of onsite… During smelter decommissioning, spent potliner was transported for disposal to a licensed hazardous waste facility, similar to what was done at the CFAC site from 1990 (shortly after spent potliner was listed as an RCRA hazardous waste) until plant decommissioning was completed in 2019. A 2018 cleanup action plan (Washington Department of Ecology

2018) included offsite disposal of soil contaminated with petroleum compounds, onsite consolidation and capping of contaminated soils, and construction of a semi-permeable reactive barrier to treat groundwater contamination. Cost was estimated at $28 million." [34]

The Spokane cleanup

Kaiser's Mead smelter near Spokane was one of three aluminum plants built for the U.S. government in the Pacific Northwest during World War II. The Mead smelter began operating in 1942 about seven miles north of downtown Spokane. The smelter eventually occupied 1,200 acres of land, with eight potlines, an anode fabrication plant with baking ovens and a coke calciner. At full capacity, the plant produced about 219,000 tons of aluminum per year. [35] Spent potliner was dumped on a 240-acre northwestern section of the Mead property from 1942 through 1978. Pots were soaked in water to loosen the brick and carbon lining before disposal. In 1978, levels of cyanide and fluoride, which were believed to have originated at the disposal site, were detected in a nearby aquifer that supplied water to a tributary of the Little Spokane River. [36]

Kaiser stopped soaking pots and discharging the effluent to the plant's sewage ponds in 1978, but the spent potliner was still on the plant site. From 1980 to 1990, Kaiser stored spent potliner at Mead in a specially-built storage building, and in 1990 Kaiser began shipping spent potliner to an offsite hazardous-waste landfill. EPA investigations discovered cyanide and fluoride in soils and in upper portions of the aquifer beneath the disposal site, which was within half a mile of a residential area. About 5,500 people used water from the same aquifer. Biological investigations in 1980 and 1995 found that a contamination plume migrating from the site was not affecting aquatic life in the Little Spokane River. Prior to being placed on the federal Superfund program's National Priorities List in 1983, alternative water supply wells were constructed for nearby residences, and an asphalt cap was placed over the disposal site to keep out precipitation. In the long-term, the EPA recommended in 2001 that a groundwater pump and treatment system be used to treat the contaminated groundwater. [37]

Cyanide was first noticed in the domestic water wells of several residences near the Mead plant in 1978. The EPA began a file on the site in 1982. Kaiser took initial action by supplying alternative water to 27 homes and businesses with contaminated wells. In July 1983, the EPA reported that Kaiser continued to take corrective actions, including the elimination of a retention pond that drained below the spent potliner dump, which transported cyanide to the nearby aquifer. Elimination of the retention pond reportedly

produced noticeable improvements. In July 1983, the EPA reported no additional remedial actions were scheduled, but monitoring would continue. Kaiser was responsible for investigating the groundwater contamination problem, and local agencies relied on Kaiser for information. The detected cyanide ranged as high as 6,447 ppb in domestic wells and 256,000 ppb in the plant's production well, which was not used for drinking water.

All told, about 2.5 million cubic feet of spent potliner waste was believed to be in the pile, about 128,000 tons spread over 25 to 30 acres, along with a 10-acre waste disposal pond for the air pollution wet scrubber system, which also received potliner-soaking pond effluent. The spent potliner pile had been exposed to rain infiltration with no impervious layer beneath the pile. In addition, the water used to soak the cathode pot bottoms was allowed to spill onto the ground, which consisted of sand, gravel and clay. Groundwater at the site was located about 145 feet below the surface. Contaminants from the spent potliner included cyanide, alumina, sodium, iron, fluoride and carbon, and the toxicity of the cyanide was rated "high." [38] Spent potliner from Kaiser's smelter in Tacoma, Wash., also was dumped at the Mead site in Spokane during the 1970s. The Mead site became one of eight Spokane Superfund sites in 1983, and Kaiser began shipping the spent potliner to a hazardous waste landfill in Arlington, Ore., in 1990. [39]

Kaiser filed for Chapter 11 bankruptcy protection in February 2002 with $3.1 billion in debts and liabilities. The company owed Spokane County $2.2 million in back taxes, including about $292,000 owed to the Mead School District. The county filed a bankruptcy claim, and the BPA filed a $70 million to $80 million bankruptcy claim. Less than a year later, on Jan. 14, 2003, Kaiser announced that the Mead smelter would likely never start back up and the company was taking a $143 million write-down on its smelter assets. Keeping the Mead smelter ready for a restart cost Kaiser about $4 million a year. The loss to the local community was about 1,200 workers and $750 million in the local economy. [40] In July, Kaiser announced plans to rezone part of the 800 acres it owned near the idled Mead smelter for housing and commercial development. [41] In October, the United Steelworkers reported that Kaiser had sold more than 100 acres of land near the smelter for $2.6 million. A Kaiser spokesperson said the land was separate from the 800 acres Kaiser was seeking to rezone for residential, commercial and light industry uses. Kaiser also had put some of its worldwide properties up for sale, including bauxite properties in Jamaica, its recently rebuilt Gramercy alumina refinery in Louisiana, and its 49% interest in the Anglesey smelter in Wales. Kaiser was hoping to use the sales of these assets to restructure itself out of bankruptcy. Interested buyers were reported to include Glencore. [42]

In a cleanup agreement between Kaiser and the Department of Ecology announced Aug. 12, 2004, Kaiser agreed to spend $20 million cleaning up a 50-acre area at the Mead site. According to the agreement, Kaiser would contribute $2.25 million toward the cleanup, and Kaiser's insurance company would cover another $18 million. The plan had to be accepted by a federal bankruptcy court. A large capped toxic waste pile would be created and then monitored for "centuries," according to a local newspaper story. The Department of Ecology admitted that the plan was a partial cleanup, and that cleaning up the entire 1,200-acre Mead facility would cost about $100 million. [43] In recognition of Kaiser's bankruptcy filing, the agreement released Kaiser from liability under both state and federal cleanup statutes. The smelter site was transferred to a trust that would administer the funds and arrange for cleanup work. Kaiser had already sold off much of its smelting assets, including the Mead smelter and much of the surrounding land, and the area holding spent potliner would be transferred to the trust.

The spent potliner had already been consolidated into one large pile and covered with an armored double-lined cap to avoid further spread of fluoride and cyanide contamination. Leaky pipes in the vicinity of the contaminated soil had been repaired. The Superfund site on the north side of the plant consisted of 128,000 tons of smelting wastes that had leached out of the pile into underlying soils and groundwater. Contaminated groundwater containing cyanide and fluoride had traveled about two miles to the Little Spokane River. According to the settlement, Kaiser would capitalize the trust with $2.25 million, which would be used to purchase an environmental insurance policy. The trust would be responsible for inspecting, repairing and reporting oversight to the spent potliner pile. The activity was funded for the next 250 years, the Department of Ecology reported. The trust would evaluate the results of groundwater monitoring in five years. [44] In September 2004, Kaiser agreed to spend $24.5 million on a separate Superfund settlement covering 66 sites, including the Spokane Junkyard in Hillyard and Commencement Bay in Tacoma. [45]

On Feb. 26, 2004, Kaiser announced plans to sell the Mead smelter to Columbia Ventures Corp. of Vancouver, Wash., for $4 million, subject to approval by the federal bankruptcy court. Columbia Ventures was an entrepreneurial firm with investments in aluminum manufacturing and telecommunications that was interested in restarting the anode baking operation at Mead so it could market prebake anodes to other aluminum smelters. Columbia Ventures also wanted to restart about 50,000 tons per year of aluminum smelting capacity, equal to at least two of the plant's potlines. Kaiser would continue to operate the Trentwood rolling mill near Spokane and a drawn-tube facility in Richland, Wash. [46] On April 10, 2004, however, Commercial Development Co. of St.

Louis out bid Columbia Ventures for the Mead smelter in federal bankruptcy court with a $7.4 million offer to Columbia Venture's $4 million. Commercial Development specialized in demolishing and cleaning up polluted industrial properties. The company said it planned to operate the carbon anode plant but had no plans to restart the smelter. Instead, it planned to clean up the site and sell it to investors. [47] Cleanup costs were estimated to range from $6 million to $25 million. The sale was subject to bankruptcy court approval, and Washington State was seeking $22 million from Kaiser to remove rubble and clean up groundwater polluted by PCBs. [48]

Plans were underway for dismantling the Mead aluminum smelter by June 2004. The plant's 1.6 million square feet of industrial space and 231 acres of industrially-zoned land with 15,000 feet of railroad track were considered a "lucrative deal" by Commercial Development Co. Inside the plant were an estimated 13 million pounds of copper worth about $16.5 million, bolstered by strong copper prices, and about 5.5 million pounds of aluminum worth about $4.5 million. Much of the aluminum remained in the bottom of the smelter's 1,125 reduction pots. Commercial Development had salvaged plants previously owned by Kraft General Foods, General Motors, Caterpillar and G. Heileman breweries. The company hired a former Kaiser electrical maintenance superintendent to help oversee the salvage operation. By November 2004, the salvage company had sold off from $4.5 million to $5 million in assets, including 64,000 tons of steel selling at high prices, thousands of tons of raw materials such as calcined petroleum coke and cryolite, and pallets of new unused materials such as insulating bricks, copper rods and tools. Tools were expected to sell for 15 to 25 cents on the dollar. Commercial Development sold 103 transformers by November, but it did not plan to dismantle the relatively new carbon plant, which Kaiser had upgraded in the 1990s at a cost of about $61 million. The salvage company planned to sell the carbon plant intact. Kaiser retained ownership of 400 acres of undeveloped land north of the smelter that it leased to a turf sod farm and a 231-acre dumping area that held spent potliner and sludge. [49]

On March 30, 2010, Ormet Corp. announced it had entered into a purchase and sale agreement for the Mead carbon anode facility. Ormet would use anodes manufactured at Mead at its aluminum smelter in Hannibal, Ohio. [50] Kaiser used about 70,000 anodes per month in the 1990s, each weighing about 420 pounds. Ormet used a different type of reduction pot with 800-pound anodes. The carbon plant at the Hannibal smelter was shut down for regulatory compliance reasons, and Ormet purchased anodes made in China. [51] On Dec. 3, 2010, Ormet announced it had terminated the original purchase agreement for the carbon anode facility. [52]

On Jan. 10, 2025, the EPA Region 8 office released to the public its Record of Decision for the cleanup of the CFAC Superfund site. Comments to the ROD sometimes referred to the cleanup at the closed Mead smelter. One comment questioning the EPA's choice of a slurry wall to contain wastes at CFAC noted that such a remedy was rejected at the Mead because implementation was "unlikely, unproven at depths required." [53] The same commenter noted how the EPA's feasibility study for CFAC "appears to incorporate groundwater extraction and treatment remedy approaches and some of the same estimated costs published in the Kaiser Mead" feasibility study, suggesting that the CFAC feasibility study should look at this further. [54] The commenter went on to note that ", the proposed Kaiser Mead system utilizes wetlands along with engineered components" while the "CFAC system utilizes more engineered components without biotreatment." Costs for operating the groundwater treatment system at CFAC should be higher than shown in the ROD because the "conceptual CFAC groundwater treatment system relies on more engineered elements and will treat arsenic in addition to cyanide and fluoride." The commenter added that "treatability studies for the Kaiser Mead site identified many issues that guided feasibility study development that will also need to be considered in evaluating remedial alternatives for the CFAC site, such as issues with chemical precipitation." [55]

In response to these comments to the CFAC cleanup record of decision, the EPA Region 8 office said it had reviewed the Final Supplemental Feasibility Study Report for the Kaiser Mead site where a deep slurry wall was screened out of detailed analysis. "The geology, hydrogeology and physical setting of the two sites are quite different," the EPA noted. "The capped spent potliner pile at the Kaiser Mead site is not seasonally saturated by a high groundwater table. The depth to groundwater is approximately 150 feet at the Kaiser Mead site, and the overlying geology consists of sand with minor gravel and silt. Because of these characteristics, an injected grout wall was selected for detailed analysis in the supplemental feasibility study for the Kaiser Mead site, as it was more feasible given the geology at the site, whereas a similar wall was screened from further analysis in the CFAC feasibility study as the site geology at the West Landfill and Wet Scrubber Sludge Pond was less amenable to that technology due to the potential presence of cobbles and boulders." The EPA added that "feasibility studies commonly select a remedial alternative, such as containment, and then screens the various technologies to select the best technology to retain for detailed analysis for the site conditions. This was done for both the CFAC FS and the Kaiser Mead supplemental FS." [56] As for the similarity in cost estimates for groundwater treatment in the Mead and CFAC feasibility studies, the EPA noted that was "likely due to both feasibility studies

being completed around the same time frame and both used vender quotes. It is likely that similar venders were contacted to provide quotes." [57]

The EPA Region 8 office provided an update on the remedial actions taken at the Mead smelter Superfund site through 2024. "The Kaiser Aluminum Mead Site is a state-led Superfund site that operated from the 1940s until the late 1970s. The 1996 feasibility study included three alternatives, one of which was off-site disposal of 128,000 tons of SPL. In 1999, the Washington Department of Ecology ordered the potential responsible party to complete a substantial and disproportionate cost analysis to compare the benefit provided by permanent removal of wastes and cleanup of groundwater alternative to each of the engineered containment alternatives. Costs for each cleanup alternative were compared to the incremental degree of protection afforded by each. The state agreed with the potential responsible party that the incremental degree of protection provided by removal when compared to the incremental increase in cost was not justified, and a containment remedy (consolidation and capping) with groundwater pump and treatment was selected in the cleanup action plan for the Mead site." [58]

The EPA added that work continued at the Mead site. "Groundwater cleanup goals have not been achieved, and groundwater capture and treatment is ongoing," the EPA reported in the record of decision. "One commenter noted that a deep slurry wall was screened out of detailed analysis of the Kaiser site because of issues similar to those found at the CFAC site, namely the depth of the slurry wall and presence of cobbles and boulders that may affect constructability. This is somewhat misleading. EPA reviewed the Final Supplemental Feasibility Study Report for the Kaiser Aluminum Mead Site (Hydrometrics 2018), and the geology, hydrogeology and physical setting of the two sites are quite different. The capped spent potliner pile at Kaiser is not seasonally saturated by a high groundwater table, as the depth to groundwater is roughly 150 feet. The overlying geology consists of sand with minor gravel and silt. Thus, an injected grout wall was selected for detailed analysis in the supplemental feasibility study at Kaiser as it was more feasible, given the site geology. A similar wall was screened from further analysis in the CFAC feasibility study as the site geology at the West Landfill and Wet Scrubber Sludge Pond was less amenable to that technology, due to the potential presence of cobbles and boulders. Feasibility studies commonly select a remedial alternative, such as containment, and then screen the various technologies to select the best technology to retain for detailed analysis depending on site-specific conditions. This was done for both CFAC and Kaiser." [59]

The Tacoma cleanup

Kaiser also owned a World War II-era smelter in Tacoma, Wash. The federal government built the smelter on the Tideflats area of Tacoma in 1942. The plant was run by the Olin Corp. until 1945 and then sat idle until 1947 when industrialist Henry J. Kaiser bought it for $3 million. At its height, the smelter employed more than 350 workers and produced about 73,000 tons of aluminum per year. A contentious 20-month labor strike and lockout from 1998 to 2000 marked the beginning of the end for the plant. High energy prices during the West Coast Energy Crisis closed the smelter for good. [60] The plant site was used to park automobiles shipped to the U.S. from Asia, and power from the smelter's BPA contract was transferred to the Mead smelter until high power prices forced both smelters to shut down. [61] On Dec. 20, 2002, the Port of Tacoma announced it would pay $16.1 million for the 96-acre smelter site. The port agreed to pay Kaiser $12.1 million up front and set aside another $4 million to pay for redevelopment costs, some of which were expected to be for environmental remediation. The smelter was located four miles east of downtown Tacoma in the Tideflats industrial region adjacent to Blair Waterway, which the port was redeveloping into a container cargo terminal. [62] The smelter site included several large structures, and the Port was responsible for all demolition and environmental remediation. An additional $4 million would be placed in escrow to handle environmental costs. "The Port has a successful record in the cleanup of industrial lands and putting them back into productive use," Port Commissioner Clare Petrich said at the time. [63]

In 2004, a Kaiser spokesperson reportedly said spent potliner cleanup at the Tacoma smelter site was costing millions of dollars. [64] By February 2005, the two alumina storage domes in Tacoma had been taken down to make room for a container-cargo terminal for Yang Ming Line, which began operations at the port in summer 2005. The domes were constructed in 1968 and 1971 and had become landmarks in Tacoma. [65] By August 2007, construction was underway for a new 1,200-foot long wharf at the site. [66] The 500-foot high smokestack at the smelter was blown up by dynamite on July 25, 2008. By that time, the Port of Tacoma had demolished 75 buildings and recycled 75,000 tons of steel, copper, aluminum, lead, concrete, alumina, oil and carbon anodes. The scrap metal was worth millions of dollars. [67] In November 2009, explosives were used to decommission a 750-foot deep well and others at the site. [68] By 2011, the Port of Tacoma had cleaned up most of the former aluminum smelter. Buildings and the smokestack were demolished, more than 43,500 tons of metals and oils were recycled, and 30,000 tons of concrete were crushed and re-used. Over 25 years, the Port had

cleaned up 420 acres of industrial land in the area. In October 2007, goats were placed on the cleaned up Tideflats industrial lands in an effort to control nonnative plants. [69]

On Feb. 22, 2010, the Port of Tacoma Commissioners announced their intention to dispute a penalty the EPA sought to impose over the cleanup of the former smelter property. The dispute focused on a half-acre area used for waste-handling that was cleaned up by Kaiser in 2002 prior to the sale of the site to the Port. Kaiser filed a report about the half-acre site with the Department of Ecology following its cleanup. Between 2003, when the Port purchased the site from Kaiser, and 2010, the Port removed thousands of tons of waste from the former smelter site, demolished buildings and cleaned up significant portions of the property. About 80 of the site's 96 acres had been returned to Port-related use. Federal hazardous waste laws mandated that private property owners file financial assurance letters each year to demonstrate that they had the means to complete the cleanup and to uphold monitoring responsibilities, and the Department of Ecology was responsible for administering the paperwork. [70]

The Port had worked with the Department of Ecology since 2003 to meet the financial assurances for the estimated $300,000 in monitoring costs for the next 20 to 30 years. Following an audit of the Department of Ecology, the EPA began to pursue the Port in 2008 for a settlement over missed deadlines. The Port worked with the EPA for more than a year to settle the matter, including offering to put money that would have gone into legal fees into a project with environmental benefits. The two parties could not reach a settlement, and the Port notified the EPA of its decision to decline the EPA's $232,000 settlement offer. [71] On Aug. 19, 2010, the commissioners agreed to a $137,000 settlement with the EPA after they recognized that the EPA had valid claims about missing paperwork. "While Port officials remain disappointed the EPA pursued any penalties in the face of a demonstrated, long-standing commitment to clean up the community, they recognize that costs related to a legal fight could equal or exceed the settlement amount," the Port said on their website. [72]

On Jan. 10, 2025, the EPA Region 8 office published its record of decision for the cleanup of the CFAC Superfund site. One commenter to the ROD that the CFAC "feasibility study and proposed plan both highlight the risks of reactive spent potliner waste and justify their proposed in-place remedy based on these presumed risks. However, the feasibility study also recognizes that these risks can be mitigated by use of long-armed excavators, personal protective equipment for workers, and methods to limit infiltration of water into the excavation. I would ask the agencies to examine the methods used to clean up the Tacoma site to reduce these risks." [73] The commenter also noted that an in-situ

remedy at Tacoma as proposed for the spent potliner wastes at CFAC "was rejected and removal was required by the Washington Department of Ecology." The final remedy at Tacoma "included complete excavation and removal of spent potliner and related wastes for the site, and shipment to the hazardous waste landfill in Arlington, Oregon. This was accomplished without detrimental impacts. There was no apparent crisis for the community involving too many haul trucks. There were no impacts associated with reactivity of the wastes, no explosions, no cyanide poisoning of workers or neighbors or anything suggested by the consultants who prepared the CFAC proposed plan. The wastes were fully characterized, excavated and hauled off site. It does make you wonder, if a State Agency in Washington can require a permanent and effective cleanup at a former aluminum smelter, and can implement the remedy without negative impacts, then why can't the EPA and State of Montana handle the task at CFAC? The EPA and State should reexamine their thinking. Clearly the statements made by the company to justify their proposed in place remedy are not fully reliable and accurate." [74]

The EPA Region 8 office responded to the comment in the CFAC record of decision by providing an update on the cleanup at the Tacoma smelter site. "The Kaiser smelter operated from 1942 to 2001, and the Port of Tacoma purchased the site in 2003. Spent potliner was stored on bare ground from 1943 to 1967, and exposure to rainwater caused cyanide and fluoride to leach into soils and groundwater. The spent potliner was eventually shipped offsite for disposal. No spent potliner was left in piles or entombed in site landfills. The commenter is incorrect with the statement that "the final remedy included complete excavation and removal of spent potliner" at this site, as there was no spent potliner. Rather, there was black carbon waste mixed with soil in the upper 0.5 to 4.5 feet of the soil profile where the spent potlner had been placed on bare ground before offsite disposal. This waste was leached from spent potliner (the term used was spent potliner material), so it was disposed at a licensed hazardous waste disposal facility. [75]

The Troutdale cleanup

Alcoa built and operated a World War II aluminum smelter for the U.S. government on the Columbia River in Troutdale, Ore., from 1941 through 1945. Reynolds began to lease the plant following the war in 1946. Alcoa merged with Reynolds in May 2000 and permanently shut down the Troutdale plant in July 2002 – another casualty of the West Coast Energy Crisis. [76] In 1994, the EPA placed the Troutdale site on the Superfund's National Priorities List. The 80.25-acre plant site came with about 715 acres of surrounding rural land and a U.S. Army Corps of Engineers dike running through the site.

Primary contaminants found in the soils included fluoride, cyanide, polycyclic aromatic hydrocarbons and PCBs. “There is a significant plume of fluoride contamination in groundwater beneath the plant site,” an August 2002 EPA report said. [77]

The Troutdale site was bordered by the Columbia and Sandy rivers. A waterbody called Company Lake was used when the plant was operating to treat process and sanitary wastewater and storm water runoff. Part of the plant site was in a 10-year flood plain, and two regional aquifer systems were located beneath the site. Some cleanup work took place between 1995 and 2002. Reynolds removed 13,900 tons of cryolite from three settling ponds, about 11,000 tons of spent potliner and contaminated soil was removed from the East Potliner storage area, and about 580 tons of PCB-contaminated soil was removed from a spill area. A diesel spill area and a network of 21 de-watering sumps for the anode bakehouse, containing fluoride, cyanide and polycyclic aromatic hydrocarbons, also were cleaned up. Nine production wells were decommissioned, and about 3,300 cubic yards of contaminated process residue in Company Lake was excavated. Another 3,800 cubic yards of contaminated waste was removed from a scrap yard. The capital cost and annual operating and maintenance cost of EPA alternatives to complete the site cleanup ran from about $8 million to $23 million. The EPA preferred a $21 million alternative. [78]

The federal Agency for Toxic Substances and Disease Registry published a public health assessment document in January 1997 describing the health risks posed by the Troutdale smelter site. At the time, Reynolds was considering restarting the plant. Spent potliner containing metals, fluoride, polycyclic aromatic hydrocarbons and cyanide had been dumped at several piles on the site. Cryolite was disposed of at onsite ponds, but contaminated wastes and soils at those ponds had been removed. Electrical capacitors containing PCBs reportedly were buried at the site, and evidence of onsite PCB contamination was found. Cleanup actions by 1997 included removal of metallic mercury and mercury-contaminated soils at the scrap yard, removal of wastes and contaminated soils from the cryolite ponds, removal of above-ground spent potliner waste and nearby contaminated soils, and properly capping a former production water well. Groundwater existed in an unconfined, relatively shallow aquifer ranging in depth from five to 18 feet. Sixteen monitoring wells were installed at the site. Groundwater at different locations and different depths was found to contain aluminum, fluoride, mercury, arsenic, several other metals, cyanide, 1,1-dichloroethan and 1,4-dichlorobenzene. The area surrounding the plant was mostly rural, and Troutdale’s 10,500 residents lived about 1 1/4 miles away. Agency officials also were concerned

about the exposure of hazardous materials to recreational users who typically boated to the plant site and picked blackberries along the Columbia River. [79]

Alcoa announced formal plans to clean up the Troutdale smelter on July 16, 2003. Alcoa planned to offer the 700-acre site for redevelopment, including the 107 acres where the smelter was located. The cleanup process was expected to take three to four years and would involve removing all buildings and structures and restoring land around Company Lake. According to an Alcoa press release, the company had a long history of successful site-restoration projects, including the 400-acre Squaw Creek Mine near Chandler, Ind. The EPA, Oregon Department of Environmental Quality and the City of Troutdale would all be involved in monitoring the cleanup. Public access through the site to the Columbia and Sandy rivers would not be allowed during the cleanup. [80] Tetra Tech of Pasadena, Calif., was awarded the remediation contract in September 2003 with a completion deadline of April 2005 and an estimated cost of more than $20 million. The 25-acre smelter site and its 110 separate buildings were expected to contain 10,000 tons of raw materials for re-use by other Alcoa plants and 32,000 tons of steel, copper and aluminum for recycling. The smelter facility was on the Superfund's National Priority List and would be the first to be demolished. Once the plant's entire 715 acres were re-mediated, the site potentially could be developed, Alcoa said. [81] By January 2004, Alcoa had begun cleaning up the Troutdale site, where 50 to 100 workers would be employed for several years under management by Tetra Tech. A big part of the estimated cleanup cost would be disposal of hazardous materials in special offsite landfills. [82]

The cleanup was completed by 2005. This included soils contaminated with PCBs, asbestos, lead, coal tar pitch, beryllium, mercury, fluoride and spent potliner. Materials handled by Tetra Tech included 39,000 windows and 700,000 square feet of roofing and siding contaminated with asbestos and PCBs; 7,634 tons of reacted alumina; 2,147 tons of coke or carbon products; 33,997 tons of steel; 11,793 gallons of used oil; 4,117 tons of copper; 1,859 tons of aluminum; 338 tons of asbestos; 6,683 tons of PCB bulk-product waste; 172 tons of PCB waste; 551 tons of recycled paper, cardboard and wood; 10,081 tons of spent potliner from 699 pots; 12,392 tons of demolition debris; 1,135 tons of cryolite bath; 898 tons of aluminum pot pads; 48 tons of federal Resource Conservation and Recovery Act waste; and 53,395 tons of non-hazardous soil, brick or process materials. About 95% of remaining equipment and tools were sold. When all above-ground structures, foundations and pipes were removed to a depth of eight feet, contaminated soil was removed and the area was back-filled and graded for its new owner, the Port of Portland, which leased the property for redevelopment. [83]

The Port of Portland had purchased the site in 2004 for $17.3 million, and the cleanup was mostly completed by April 2011. The cleanup work won the annual grand prize from the Pennsylvania-based Phoenix Awards Institute. About 50 acres of soil had been contaminated by spent potliner dumped in the swampy backyard near the Sandy River. The contaminated soil had been hauled off to a landfill upriver, and the groundwater was pumped clean. The site would soon be home to a $130 million FedEx distribution hub on 78 acres expected to employ 750 to 1,000 workers – more than Reynolds employed at the smelter. About 288 acres remained for industrial development which was expected to employ 3,500 workers. The Port of Portland said cleanup and redevelopment cost about $223 million, with much of that money coming from Alcoa's mandated Superfund payments. [84]

On Jan. 10, 2025,the EPA Region 8 office published its record of decision for the cleanup of the CFAC Superfund site. The EPA summarized cleanup efforts at Troutdale through 2024. "The Reynolds Metals Company aluminum smelter operated from 1941 to 2002 along the Columbia River, about 20 miles east of Portland. The site was listed on the National Priorities List in 1994. Early removal actions included excavation of 13,900 tons of cryolite from settling ponds and 11,000 tons of spent potliner from a storage area, for disposal at an offsite disposal facility. The EPA's review of these interim actions could not determine if the excavated spent potliner was from a pile or a landfill. After early removal actions, Reynolds conducted a remedial investigation and feasibility study from 1996 to 2000. It identified remaining contamination in soil, waste and debris in several disposal areas and in process waste and sediment at the bottom of a settling pond known as Company Lake. An interim record of decision was issued in 2002 that required excavation of contaminated soils and wastes from historic site landfills and consolidation into the onsite North Landfill. A final record of decision was issued in 2006. It required further groundwater extraction and treatment, as well as continued groundwater monitoring. In 2018, the EPA conducted an optimization review of the remedy, and recommendations from that review are currently being implemented. As noted in Fourth Five-Year Review Report for Reynolds Metals Company Superfund Site, groundwater is still being captured and treated, despite previous removals, offsite disposals of soils and wastes, and ongoing treatment." [85]

The Dalles cleanup

Harvey Aluminum's 54,000 ton-per-year smelter on the Columbia River at The Dalles, Ore., began operating in 1958. Harvey initially planned to enter the U.S. aluminum industry by building an aluminum smelter in the Flathead Valley in the early 1950s, and

the smelter at The Dalles was similar in design to the Anaconda Aluminum Co. smelter in Columbia Falls and used similar Soderberg-type reduction pots. [86] The smelter went through several owners after Harvey and was shut down during the West Coast Energy Crisis. Golden Northwest Aluminum, which also owned the smelter across the river in Goldendale, Wash., filed for bankruptcy in December 2003. [87] The EPA first proposed placing the smelter site at The Dalles on the Superfund's National Priority List in October 1984. The site was removed from the list in July 1996, but the EPA continued with a five-year review process through 2010. The EPA selected a two-part cleanup process for the site in 1988. The potentially-responsible parties completed the first phase in 1990 and the second phase in 1991 under consent decrees with the EPA. The 350-acre Superfund site was located within an 800-acre area primarily used for heavy industry. According to the EPA, 28 acres were contaminated by treatment, storage and disposal of waste. A 15-acre landfill that was capped contained about 200,000 cubic yards of industrial waste and construction debris, including asbestos, metallic wastes and 5,000 tons of spent potliner that contained cyanide, polycyclic aromatic hydrocarbons and arsenic. Leachate from the landfill had been contaminating groundwater until a collection system was installed. A 15-acre site called the unloading and cathode waste management area had 64,670 cubic yards of cathode waste, which had contaminated sludge and subsoil. [88]

The cleanup project at The Dalles was one of the largest in the region and involved demolishing 29 buildings covering more than 3 million square feet, with the potential to create 400 to 1,000 jobs in the huge recycling effort. The first phase, in which equipment was removed, pots were cleaned and dismantled and metals were reclaimed, took about a year and employed 65 contract workers and 10 Golden Northwest employees. Envirocon Inc., the company that also worked on the Longview smelter cleanup, was brought in for the second phase. Buildings were removed, metal was prepared for resale, and concrete was removed and tested to see if it could be used for backfill. James Dean Construction, a local company, was brought in for the third phase, where concrete was crushed and put into the basements. When the basements were filled to within three feet of the surface, clean fill from James Dean's gravel pit was used to backfill the area to grade. During the entire project, CH2M Hill, an environmental consulting company, sampled soil, groundwater and concrete for contaminants. Golden Northwest received a clean-fill determination from the Oregon Department of Environmental Quality. All told, 54,000 tons of concrete were crushed and used for backfill, saving $2 million in disposal costs. About 65,000 tons of carbon, aluminum, steel, copper, equipment and construction materials were recycled. The project drew international attention, and architects from Germany worked on designs

for the reclaimed land. When completed, 101 acres of land were available for industry. In October 2007, Golden Northwest applied to have the property certified as an industrial site by the Oregon Economic Development Department, the final step in having the 280-acre site cleaned up for sale and reuse. [89] The smelting facility was completely dismantled by 2009. [90]

While the smelter and related infrastructure at The Dalles was gone, the casting plant remained in operation as Northwest Aluminum Specialties, which was owned and operated by its 90 employees. The plant recycled pucks and slugs from impact-extrusion, forging and direct-extrusion industries and made alloyed aluminum billets for export. The remelt process used only 5% of the energy needed for smelting alumina. Unlike the other Pacific Northwest aluminum plants, Northwest Aluminum Specialties stayed operating throughout the entire 2000-2001 West Coast Energy Crisis. Northwest Aluminum Specialties was a subsidiary of Golden Northwest Aluminum until it was purchased in 2006 by its employees – all members of the United Steelworkers. On July 9, 2007, Northwest Aluminum Specialties announced it had acquired more credit for upgrading its facilities. [91] On Sept. 22, 2015, SAPA Extrusions of Norway announced it had acquired the Northwest Aluminum Specialties remelt facility at The Dalles. SAPA had 110 plants around the globe. Northwest Aluminum was facing serious financial difficulties at the time. [92] SAPA acquired the plant, property, equipment and inventory and looked to keeping on the 50 employees. Including the plant at The Dalles, SAPA had facilities at nine locations around the U.S. that included extrusions and cast houses. [93]

On Jan. 10, 2025, the EPA Region 8 office published its record of decision for the cleanup of the CFAC Superfund site. One commenter to the ROD noted that the "EPA needs to review the cleanup of our sister plant at the Dalles, as she was a mirror image of ours, and an assessment of it should be done in relation to this project." [94] The EPA responded to the comment with an update of cleanup work at the Dalles through 2024. "The Dalles plant (referred to as the Martin-Marietta Aluminum Co. site) operated from 1958 to 1987 and is a Superfund site. The EPA's selected remedy in the 1988 record of decision included consolidating remaining waste materials into an existing landfill, capping that landfill with a multi-media cap that meets RCRA performance standards for hazardous waste landfills, and capturing contaminated groundwater and landfill leachate for treatment and discharge. The 15-acre landfill includes 200,000 cubic yards of industrial waste and construction debris and 5,000 tons of spent potliner. Treatment of landfill leachate continues, as documented in the Sixth Five-Year Review Report for Martin- Marietta Aluminum Co. Superfund Site, Wasco County, Oregon, completed for the site in May 2023." [95]

The Goldendale cleanup

In 1970, Harvey Aluminum began operating an aluminum smelter on a 7,000-acre site in Goldendale, Wash., on the north side of the Columbia River beside the John Day Dam. The 178,000 ton-per-year plant, similar in capacity to the plant in Columbia Falls, consisted of a carbon paste plant, four pot lines, a casting house, a laboratory, administrative offices and a sewage treatment plant. The plant had one wastewater discharge outfall that emptied, after treatment, directly into the Columbia River. [96] The aluminum plant at Goldendale underwent several ownership changes. Harvey Aluminum was acquired by Martin Marietta in 1972 shortly after the smelter went into operation. The smelter was acquired by Comalco in 1984 and then Golden Northwest Aluminum in 1987. By 1994, the smelter was 70% owned by the Columbia Aluminum Corporation and 30% by employees. [97] Northwest Aluminum Co. acquired the smelter in May 1996 and ran it under a 10-year tolling contract with Norsk-Hydro. [98] From 1988 through 2003, according to the EPA's Toxic Release Inventory and self-reporting by the company, the Goldendale smelter released more than 4.2 million pounds of aluminum oxide, 1,446 pounds of benzo(g,h,i)perylene, 670,748 pounds of carbonyl sulfide, 36,670 pounds of chlorine, 515,731 pounds of hydrogen fluoride, 359 pounds of lead and 8,419 pounds of polycyclic aromatic compounds. [99]

The Goldendale smelter closed in April 2003 after limited restarts following the West Coast Energy Crisis, and the owners filed for bankruptcy in December 2003. [100] Golden Northwest Holding Co. removed the reduction pots at the smelter in 2008. The pots were similar to the type used at Columbia Falls. Plans called for demolishing the plant's buildings and structures in spring 2011 and then beginning soil cleanup. [101] Comments were sought for the cleanup project in February 2011. The Columbia Gorge Aluminum Co., the last entity to hold title to the site, applied to the Klickitat County Planning Department for a permit to demolish the buildings at the site. The company wanted to demolish four potrooms and the concrete foundations and floors. The county planning department had already issued a mitigated determination of no significance. [102] Magnus Pacific demolished and excavated the smelter buildings at Goldendale in spring 2011. More than 250,000 tons of concrete structures were demolished, crushed and used as onsite fill. Rebar was recovered and recycled. About 100,000 tons of soils contaminated with polycyclic aromatic hydrocarbons and metals from courtyards between the potrooms were excavated and transported off-site, and the cathode reduction and demolition room, where pot cathodes were dismantled prior to disposal, were demolished. [103]

On Jan. 10, 2025, the EPA Region 8 office published its record of decision for the cleanup at the CFAC Superfund site. In the ROD document, the EPA summarized cleanup efforts at Goldendale through 2024. “The Columbia Gorge Aluminum Smelter operated from 1970 until its closure in 2003. Located next to the John Day Dam along the Columbia River, it is being cleaned up under the oversight of the Washington Department of Ecology. Spent potliner was initially stored on concrete pads, one of which was later capped under solid waste disposal regulations. A 1989 report estimates that 120,000 tons of SPL was closed in this landfill. The Final Draft Remedial Investigation Report, Columbia Gorge Aluminum Smelter Site was completed in 2022 (Lockheed Martin and NSC Smelter 2022). The feasibility study is not yet available.” [104]

The Intalco cleanup

In 1966, American Metal Climax and Howmet, the latter controlled by Pechiney, joined forces to build a new aluminum smelter called Intalco on the Straits of Georgia and Puget Sound in Ferndale, Wash. Using Pechiney’s high-capacity and highly automated potlines, the new smelter was rated at 260,000 tons per year. [105] According to William H. Rodgers Jr. in his 1973 book “Corporate Country,” soon after the smelter began operating, Intalco used a ditch to “divert illegally millions of gallons of effluent from its plant” to a natural drainage and over a bluff onto state-owned tide lands. Eventually the bluff eroded away, depositing 300,000 cubic yards of earth on the beach. [106] Rodgers said Intalco proclaimed at the plant’s start-up in 1966 that it had “spared no expense in efforts to control pollution,” but the company was allowed a five-year delay in the installation of a primary treatment plant for wastewater discharge. A marked deterioration of water quality over more than four square miles around the plant’s wastewater outfall was documented by 1971. As the company came under fire for the pollution, Intalco wrote to the BPA promising that it would meet state water pollution standards. A BPA representative explained the Intalco situation to the U.S. House Subcommittee on Conservation and Natural Resources during a 1971 hearing on “Protecting America’s Estuaries: Puget Sound and Juan De Fuca.” BPA Administrator H.R. Richmond explained the BPA’s reluctance to crack down on Intalco during the initial five-year period in a Nov. 24, 1971 memo. “Specifically, we were not informed by (the state agencies) of any official complaint having been received relative to Intalco’s operations,” he wrote. Richmond’s explanation did not take into account documented damage and a dozen pending lawsuits, Rodgers noted. [107]

In 1997, Intalco applied to renew its wastewater discharge permit from the Washington Department of Ecology for another five years. The wastewater was discharged into the

Strait of Georgia at two locations, and effluent levels were determined by using EPA guidelines and "best professional judgment." Most of the proposed limits existed in the prior permit, "which were more stringent than the categorical standards." Analysis was based on the "worst case scenario" and biological monitoring of the 200-foot radius mixing zone at the point of discharge. About 3.5 million gallons per day of process wastewater was discharged from a 24-inch pipe run out on the shipping pier about 1,100 feet from shore. Process water originated from the Nooksack River and was used as cooling water for anodes and casting, and in the wet scrubbers to clean secondary potroom gases. The process-water discharge also contained some treated solid-waste leachate and treated chlorinated sewage. Limits on the process-water discharge was an average of 68 pounds of fluoride per day, with a maximum of 296 pounds of fluoride per day, less than 0.012 mg/liter of cyanide, less than 0.0025 mg/liter of benzo(a)pyrene, and no limit to temperature. The second discharge was located 800 feet south of the process water discharge and 250 feet from shore and was used for stormwater runoff. The stormwater discharge was a 30-inch pipe averaging 500,000 gallons per day. Since 1991, the Intalco plant had exceeded its permit limits 78 times for aluminum, biological oxygen demand, total suspended solids, benzo(a)pyrene, chlorine, pH and fecal coliform. According to the Washington Department of Ecology permit report, "about half of the exceedances were due to situations beyond the control of the permittee or an upset condition," such as storm events or technical problems at the water supply utility. Enforcement action was taken for 40 of the times that levels were exceeded. [108]

On March 9, 1998, Alcoa announced that it was buying Alumax Inc., the nation's third largest aluminum producer, for $2.8 billion in cash and stock. Alumax operated five smelters in the U.S. and Canada with sole ownership or with a consortium. The Intalco plant was the largest Alumax smelter, producing 272,000 metric tons of aluminum per year. [109] Alcoa followed up with an announcement in June 2006 that it planned to buy the Mitsui & Co. and YKK Corp. stakes in the Intalco smelter. Alcoa already owned 61% of the smelter. [110] Two months later, Alcoa signed a five-year power contract with the BPA. The BPA offered Alcoa a long-term contract for the Intalco plant in October 2008, but the stock market collapse and deep global recession created less demand for aluminum, and Alcoa implemented budget changes, cutting about 100 jobs. [111]

In July 2009, the BPA and Alcoa reached a tentative agreement for sufficient low-cost power to run Intalco at or near two-thirds capacity for seven years, guaranteeing at least 528 jobs, but a court ruling in September 2009 restricted the BPA's authority to share power with Intalco, putting the July 2009 deal in jeopardy. In December 2009, the BPA approved a two-phase contract, keeping 528 workers employed for 17 months

followed by five more years of power if the courts approved the plan and economic conditions were right. In October 2010, the BPA agreed to a short extension of its Intalco power contract through May 2012. In December 2012, the BPA signed a 10-year power contract with Intalco. By 2013, the smelter was operating at 80% capacity, producing about 230,000 tons per year. In November 2015, Alcoa announced it was idling its Intalco and Wenatchee smelters, but in May 2016, the BPA and Alcoa finalized a contract amendment providing power through September 2022. [112] In May 2016, Alcoa announced that a new power agreement with the BPA along with $3 million in Washington state funding would stop the Intalco smelter from closing in June. The state money went to worker training, which kept the Intalco plant competitive. [113]

On Jan. 10, 2025, the EPA Region 8 office published its record of decision for the cleanup of the CFAC Superfund site. It summarized cleanup efforts at Intalco through 2024 in the ROD. “The Intalco Aluminum Corp smelter operated from 1966 to 2020, when Alcoa announced that it would be permanently closed. The site has five landfills, three which were unlined historic landfills that operated from the start of smelter operations until the mid-1970s. Site investigations from 2000 to 2002 indicated that waste in two of the historic landfills consisted of brick, concrete, metal and wood fragments, aluminum, and sand and gravel mixed with black organic material that was interpreted to potentially be potroom bath, minor potliner debris, construction debris from plant construction, and paste plant waste. The two other landfills were built in the late 1980s. One was double-lined for solid waste and the other was triple-lined per RCRA Subtitle C design criteria for hazardous waste. A 2001 remedial investigation and feasibility study evaluated two remedial alternatives for the historic landfills that contained process wastes and were releasing contaminants to the environment. Those alternatives were excavation and disposal to: (1) a permitted, off-property landfill; or (2) the onsite solid waste and RCRA hazardous waste landfills. …The Washington Department of Ecology selected excavation and disposal of wastes into the two existing onsite landfills. The department noted that ‘onsite disposal was considered to have less difficulty in managing short-term risks and is less costly than removal and disposal of waste in an off-property landfill.’ Cleanup was conducted in 2006. Samples collected from seeps below the historic landfills since then have had fluoride, weak acid dissociable cyanide and total PCBs that are below cleanup levels, indicating that cleanup was successful.” [114]

The Ormet cleanup

Pollution problems caused by spent potliner and other hazardous materials can be found at aluminum smelters across the U.S., including the 200-acre Ormet aluminum

smelter plant that began operating in Hannibal, Ohio, in 1958. About 85,000 tons of spent potliner material was stored at the Ormet site in an unlined open storage area or in an unlined landfill adjacent to the Ohio River between 1958 and 1968. The drinking water well for the 3,000 employees at the smelter and the adjacent rolling mill was within 2,000 feet of the spent potliner waste dumps. In 1973, Ormet installed two interceptor wells to extract a contaminated groundwater plume before it could migrate to the drinking water well. The interceptor wells removed 225 gallons of contaminated water per minute. The groundwater was contaminated with cyanides, arsenic and fluorides. The soils and sediments in one backwater area were also contaminated with PCBs. [115]

Ormet and the EPA developed a cleanup program which included excavation of the PCB-contaminated soils and sediments, capping the landfill, installing a flushing system on the spent potliner storage area, and continuing the extraction and treatment of contaminated groundwater by the interceptor wells. [116] Ormet entered into an administrative order on consent with the EPA and the state of Ohio in May 1987 to address the contaminants. A 47-acre parcel of land on the northeast corner of the site was placed on the Superfund's National Priorities List in July 1987. Cleanup of the site began after 1997, which included intercepting and treating contaminated groundwater, pumping of a production well for plume contaminants, soil flushing of the former spent potliner storage area, construction of a licensed landfill and storage cell, removal of contaminated soil and sediment and placing that material in the landfill and a storage cell, and long-term monitoring and limiting uses and access for the site. [117]

On April 5, 2000, the Ohio Supreme Court ruled 6-1 against Ormet after it tried to get its insurers to pay for cleaning up the contaminated groundwater. According to documents filed in the case, Ormet had been warned in 1956 during the design and construction phase that wastewater lagoons would contaminate its well, but Ormet took no action. By 1966, Ormet knew its wells were contaminated with fluoride at a rate 12 times higher than drinking water standards. In 1971, Ormet learned the wells were contaminated with cyanide at a level 50 to 200 times higher than drinking water standards or the standard for wastewater entering the Ohio River. Following advice of a consultant, Ormet installed an interceptor well between the lagoons and the well in 1972 to 1973, but Ormet didn't treat the interceptor well water and simply dumped it into a storm drain that emptied into the Ohio River. In 1975, the EPA issued its first wastewater discharge permit to Ormet, allowing the company to dump wastewater into the Ohio River with no cyanide limit. In 1977, a consultant for Ormet discovered that

cyanide and fluoride levels in groundwater at the site were 500 times above national limits. [118]

According to the 2000 court ruling, former Ormet board member Charles Bradley testified that he and R. Emmet Boyle knew about the contaminated groundwater prior to Boyle purchasing Ormet in a leveraged buyout in 1986. Ormet sued four insurance companies in 1995 that had provided liability coverage for the company in the 1950s and early 1970s, but the insurance companies responded that Ormet had failed to comply with their policies by not notifying the insurance companies of environmental problems in a "timely fashion." The Ohio Supreme Court ruled in favor of the insurance companies on April 5, 2000. Ormet announced the 40-acre site had been cleaned up at an estimated cost of $31 million in October 1998. In an April 26, 2000 column on the case called "Don't Drink The Water," Ohio Supreme Court Associate Justice Paul E. Peifer said a consultant advised Ormet before the plant was built to line its disposal lagoon and to install an interceptor well between the lagoon and the plant wells, but Ormet did neither. The contamination not only affected drinking water but also production processes. Peifer said he was the lone dissenter in the ruling against Ormet – not because he believed Ormet was correct but because he "felt that this was a case where the conditions, the potential liability and the law were evolving over a long period of time, and there was no real 'event' to measure timeliness." He said he would have preferred a jury determination. [119]

Ormet Corp. filed for Chapter 11 bankruptcy on Jan. 30, 2004. The company claimed rising medical benefit costs, low aluminum metal prices and weak demand prevented it from meeting debt payments. [120] The company climbed out of bankruptcy protection only to file for bankruptcy again on Feb. 25, 2013, citing high power costs and low metal prices for the reason. [121] In June 2013, a bankruptcy court approved the sale of the company's entire assets to Smelter Acquisition LLC, a portfolio company owned by a private investment fund managed by Wayzata Investment Partners LLC. [122] About four months later, Ormet announced full curtailment of operations at the Hannibal smelter. [123] The 270,000 ton-per-year smelter was put up for sale as part of bankruptcy proceedings in February 2014. Ormet promoted the sale by saying the outlook for aluminum demand was strong, driven by increased use by automobiles and changing demographics around the world. [124]

Niagara WorldWide acquired the Hannibal aluminum plant on June 27, 2014, and permanently closed it one month later, laying off the last 20 workers at the site. Another 3,000 Ormet workers were on layoff and another 1,000 were retirees. The Ormet

smelter was essentially the only employer for rural Monroe County, Ohio, and Wetzel County, W. Va. [125] Eric J. Spirtas bought the Ormet property out of bankruptcy for $25.25 million in 2014 and started demolition of the smelter facilities. He also began to develop the Center Port Terminal facility on the Ohio River not far from the planned Dilles Bottom PTT Global Chemical ethane cracker. Much of the smelter's parking lot was used to store steel pipe or fracking sand for the oil and natural gas industry. The property was listed on the Appalachian Partnership For Economic Growth website. [126]

The Ravenswood cleanup

About 70 miles downriver from the Ormet smelter was the Ravenswood aluminum plant in West Virginia. On Sept. 5, 1955, Kaiser announced plans to spend $280 million to expand its production capacity by 50%, including building a $120 million 220,000 ton-per-year aluminum reduction plant in Ravenswood. The Ravenswood plant would receive 450 megawatts of electrical power from coal-fired plants through a 40-year contract with the American Gas and Electric Co., the largest single power contract in U.S. history. The selection of Ravenswood as the site for its large smelter signaled a major move away from traditional power sources used by aluminum smelters – oil, gas and hydro. The plant was located near the Ohio River, which provided cheaper transportation costs for bulk materials. [127] By May 1958, Kaiser's $216 million rolling mill plant at Ravenswood was in full-time operation. The facility included an $8 million 168-inch reversing breakdown mill capable of rolling 10,000-pound ingots into 3-inch slabs at 300 to 600 feet per minute, the first step in the overall production of plate or foil. The machine was thought to be the largest of its kind in the world. At the other end of the process, hot-rolled coil one-tenth of an inch thick came out of other rollers at the rate of 1,250 feet per minute. With the mill in full operation, the Ravenswood facility became a fully integrated smelter and fabrication center. [128] In February 1989, the Ravenswood facility was sold to Stanwich Partners and operated under a new entity called Ravenswood Aluminum Co. Over time, the United Steelworkers and others established that Marc Rich & Co. was the primary owner of the plant. In the mid-1990s, Marc Rich & Co. became Glencore, and Glencore created Century Aluminum Co. to be a holding company for some of Glencore's U.S. aluminum interests. [129]

In May 1996, the Ravenswood aluminum plant went public as Century Aluminum and moved its headquarters to California. The move came after a contentious 20-month long labor dispute. [130] Century sold the Ravenswood rolling mill to Pechiney in 1999. Century planned on keeping the 168,000 ton-per-year smelter, but in order to maintain contracts with two of its clients, Century needed to come up with a new power supply

contract by 2003. [131] Century idled the Ravenswood plant in February 2009. Two years later, the company had completed a detailed analysis of work needed to get the plant running again, but Century still needed a good power contract. [132] On Dec. 14, 2012, the West Virginia Public Service Commission ruled that it would not reconsider Century's request for a special power rate. The company was offered a 10-year power deal if it would accept responsibility for making up the difference between the rate and actual power costs. Century rejected the offer, saying it would not allow the company to restart the smelter. In June 2013, it was reported that the EPA had ordered Century to update its cleanup plan for the Ravenswood smelter. Officials claimed soil and groundwater were contaminated by cyanide, fluoride, lead, arsenic and other pollutants. The cleanup work included restoring contaminated groundwater to drinking water standards and controlling human and environmental exposure to hazardous wastes in the soil. [133] Century announced the smelter's permanent closure in 2015. According to a filing with the Securities and Exchange Commission in December 2016, Century had sold the smelter to Applied Partners of New Jersey for $15 million. Applied Partners planned to demolish the plant and redevelop the 1,800-acre property within 18 months. [134]

The Eastalco cleanup

The 175,000 ton-per-year Eastalco smelter, which initially was owned by Pechiney and Alumax, began operating on a 1,900-acre site in Frederick County, Md., in 1970. The smelter took up about 350 acres of a 1,900-acre site, part of which was farmed by the company. According to court testimony in 1978, the site was chosen because of its proximity to the port in Baltimore and access to relatively cheap electrical power at the time. [135] In June 1984, the Maryland health department issued Eastalco a permit to build a landfill on 500 acres of former dairy farming land for spent potliner contaminated with cyanide and fluoride residues, despite the opposition of local residents concerned about groundwater pollution. [136]

In 1983-1984, perchloroethylene, cyanide and fluoride contamination were detected in the groundwater at the Eastalco site. Additional investigations conducted between 1983 and 1989 identified soil and shallow groundwater located near the electrical power substation as the source of the PCE. The source of the cyanide and fluoride in the shallow groundwater was attributed to a spent potliner waste storage area near the plant. Alcoa conducted multiple drinking water quality assessments of the nearest private wells, located in Manor Village, about 1.25 miles down-gradient of the plant site, but no PCE, fluoride or cyanide was detected. Between 1988 and 1991, Alcoa identified

and eliminated potential groundwater contamination sources by disposing of 36,000 tons of spent potliner at an approved out-of-state landfill, storing spent potliner carbon in a building until its off-site removal, capping old on-site disposal sites, and installing a leachate collection system for an on-site industrial landfill. The PCE source areas were addressed through excavation and removal of soil from the substation area. [137]

In 1992, the Maryland Department of the Environment and Eastalco entered into a consent order which included installation of a vacuum extraction system for additional PCE remediation in groundwater near the substation and implementation of a groundwater and surface water monitoring program. The consent order was amended in 1997 to include the installation of a groundwater pump and treatment system near the source of the fluoride plume. Following additional assessment, remediation and monitoring of the groundwater, soil and surface water in and around the plant site, a new consent order was signed in 2007, which eliminated PCE as a concern and required Alcoa to continue semi-annual groundwater and surface water monitoring for fluoride and cyanide. [138]

Between 2003 and 2005, five additional historical waste disposal sites and buried debris were discovered in a 53-acre grassy field located south and west of the plant operation area. Following detection of elevated levels of PCBs and polycyclic aromatic hydrocarbons in the soil, the Maryland Department of the Environment requested Alcoa to conduct additional site characterization and determine the vertical and horizontal extent of contamination. Four other waste disposal sites on the site were eliminated from further consideration due to records showing the closure of these waste disposal sites in the 1980s with state approval. [139]

In December 2006, environmental and health experts at Johns Hopkins University reported that groundwater migrating away from the smelter site contained unsafe levels of fluoride for drinking water. The contaminated groundwater plume had reached one farm which already was using public water. Neighbors opted to have their wells checked. One expert suggested the contamination would not get worse because the source of the contamination had been shut down – Eastalco personnel had discovered a leak in the liner of a pond used to store contaminated materials before the materials were hauled to an industrial landfill. Experts said the contamination would be safely diluted in four to eight years as the underground plume spread outwards. [140] Alcoa, which had acquired Alumax, announced plans in April 2010 to permanently shut down and demolish the Eastalco plant because of high power prices. Demolition costs were estimated to be $10 million. [141] By July 2012, reclamation and demolition was continuing

on the 130-some buildings at the Eastalco site. A manufacturing company reportedly was looking at acquiring the site, and the Frederick County Commissioners had revised an agreement that limited portions of the site to only aluminum production. Alcoa also had applied to remove some zoning restrictions placed on portions of the site by a new comprehensive plan. [142]

Between 2012 thru 2014, Alcoa completed additional site characterization activities and designated a 200-acre area where additional environmental requirement needed to be completed to manage residual PAH, PCB and inorganic contamination in soil, surface water and groundwater. A site management plan was proposed to manage residual contamination on plant site and was approved in 2017. The site management plan as well as other site-specific restrictions were implemented through the recording of an environmental covenant in the Frederick County land records on Dec. 29, 2017. The covenant requires current and future owners of the plant site to adhere to the site-wide land and groundwater use restrictions, continue maintenance and monitoring of remediation measures, including engineering controls already implemented on site, continue long-term groundwater and surface water monitoring, and implement the approved site management plan during any activity in the soil management area. With the implementation of the covenant, the consent order was deactivated, and on May 15, 2018, the Maryland Department of the Environment issued a no further action determination for the Eastalco plant site. 143

The Massena cleanup

Alcoa also was involved in an expensive cleanup in upstate New York that involved one of the oldest aluminum plants in the U.S. In 1903, the Pittsburgh Reduction Co. built a smelter and fabrication plant at Massena which was powered by the St. Lawrence River Power Co. The company that later became Alcoa bought the power company in 1904. Over the decades, the aluminum plant was expanded to include a laboratory, wire and cable mills, and a railroad. By 2000, the Massena West plant was the oldest continuously operating aluminum smelter in the U.S., producing about 125,000 tons per year. [144] Reynolds Metals built a smelter east of the Alcoa plant in 1959 which became Alcoa's Massena East plant after the two companies merged in 2000. The Massena East plant was capable of producing 123,000 tons per year using 500 Soderberg-type reduction pots. According to the EPA's Toxic Release Inventory and self-reporting by the company, from 1988 through 2009 the Alcoa aluminum smelter at Massena East released 44,860 pounds of anthracene, 5,887 pounds of benzo(g,h,i)perylene, 225,600 pounds of benzene, more than 2.6 million pounds of carbonyl sulfide, 2,014 pounds of chromium,

51,626 pounds of chlorine, 3,342 pounds of copper, 37 pounds of cyanide, more than 2.4 million pounds of hydrogen fluoride, 1,139 pounds of lead, 4,235 pounds of manganese, 29,149 pounds of zinc compounds and 591,323 pounds of polycyclic aromatic compounds. [145] The Massena East plant was permanently shut down in March 2014. [146] Alcoa announced the permanent closure of the Massena West plant in November 2015 as the company continued to shut down its smelting capacity across the U.S. A source close to the Massena West operation told local media the plant was losing about $1 million a week. [147]

According to a February 2012 EPA report, the 2,700-acre Massena West site included a smelter, ingot extrusion area and fabricating area. Fourteen areas at the site had been cleaned up under the authority of the New York Department of Environmental Conservation by 2001. The Massena West site was bordered by the St. Lawrence River on the north, the Massena Power Canal to the southwest and the Grasse River to the southeast. During operations, Alcoa discharged wastewater to the canal and the Grasse River through four permitted outfalls. As a result, sediment had become contaminated by PCBs in the immediate river system and for seven miles downstream. PCB contamination had been found throughout the entire length of the Lower Grasse River, from the canal to the St. Lawrence River. The seven-mile long stretch was believed to contain 1.25 million cubic yards of contaminated sediment. Consumption of fish or wildlife from the contaminated areas was a concern. The New York State Department of Health issued an advisory for the Lower Grasse River warning that the fish should not be eaten. About 3,000 cubic yards of contaminated sediment was dredged from near one of the outfalls in 1995, and about 8,000 pounds of PCBs was found in the removed sediment. Another 24,000 cubic yards of contaminated sediment was dredged out of the river in 2005. [148] In November 2012, the EPA announced plans to dredge a 7.2-mile long stretch of the Grasse River, remove 109,000 cubic yards of contaminated sediment and replace it with clean fill. Alcoa would pay $243 million for the cleanup work. [149]

The Badin cleanup

Another historic aluminum smelter owned and operated by Alcoa was at Badin, in Stanly County, N.C. Alcoa purchased the unfinished aluminum plant from the French company L'Aluminium Francaise in 1915 as World War I broke out. Two years later, Alcoa had the smelter up and running, later expanding to three new hydropower plants on the Yadkin River. In 1920, Congress enacted the Federal Power Act, giving the federal government control over navigable rivers, and Alcoa was licensed to operate the Yadkin Project. Alcoa re-licensed the Yadkin Project for another 50 years in 1958 with support from the

state of North Carolina, which cited Alcoa's plans to double the capacity of the smelter and build a fourth hydropower plant on the Yadkin River, creating 900 jobs. [150] On July 31, 2002, Alcoa announced plans to idle the 120,000 ton-per-year smelter in Badin, which had been operating at 90,000 tons per year. [151]

In 2006, Alcoa Power Generating Inc. applied to the federal government to extend the license for the Yadkin River hydroelectric plants to 2058. Alcoa shut down production at the Badin smelter in 2007. [152] That same year, a total of 23 stakeholder groups and individuals signed a re-licensing settlement agreement with Alcoa in support of re-licensing if certain conditions were met. But a group called Yadkin Riverkeeper as well as officials from Stanly County and other public officials were opposed. They claimed Alcoa polluted the area and failed to provide jobs. [153] In 2008, Stanly County challenged Alcoa's application to the state for a water quality permit under Section 401 of the federal Clean Water Act. In 2009, the state challenged Alcoa's license renewal, claiming the company had been a bad steward of the river. With the water quality permit issue still pending, the Federal Energy Regulatory Commission deferred its decision on the hydropower license, and Alcoa continued to operate the Yadkin Project under a temporary license. [154]

Alcoa announced plans to permanently shut down and demolish the Badin smelter on April 5, 2010. Global demand had not rebounded as quickly as steel and other metals since the recession began in December 2007, and the price of aluminum had dropped from $3,000 per ton in October 2009 to $2,300 per ton in April 2010. Meanwhile, Alcoa had announced plans to increase its investment in a $10.8 billion aluminum complex in Saudi Arabia from $900 million to $1.1 billion. [155] Badin had a population of about 1,800, and the smelter site included about 123 acres. [156] On Dec. 1, 2010, the North Carolina Division of Water Quality revoked Alcoa's Section 401 water quality certification, which had been issued in May 2009. Alcoa needed the certification to renew licensing for its Yadkin River dams. The state agency said Alcoa intentionally withheld information about its ability to meet standards for dissolved oxygen. [157]

In January 2011, Alcoa announced plans to spend $10 million demolishing the former Badin smelter and upgrading the facility so it could be used for future industrial development. Alcoa was still working on renewing a 50-year license for the Yadkin River hydroelectric dams. [158] Environmental activists, lawyers and residents from Stanly and Rowan counties asked the North Carolina Department of Environmental Quality during a public meeting on July 1, 2015, to deny Alcoa a wastewater discharge permit and instead require Alcoa to clean up wastes from the Badin smelter. Yadkin Riverkeeper

representative Will Scott asked for stricter water quality standards if the state decided to issue the permit. Scott suggested that industrial waste stored in a landfill near the Badin Works was leaching into the ground and stormwater before draining into nearby streams and lakes. “We see continued discharges of cyanide above the levels which the (Environmental Protection Agency) has set to protect aquatic species,” Scott said. [159] In November 2011, the Yadkin Riverkeeper environmental organization announced plans to sue Alcoa to force it to clean up contamination from Badin Lake. The group claimed PCB contamination had been found in the lake. [160]

Many of the problems encountered during cleanup projects at aluminum smelters around the Pacific Northwest and the rest of the U.S. could be found at the aluminum smelter at Columbia Falls. The Anaconda Company and subsequent owners did not discharge wastewater directly into the Flathead River, but industrial wastes were dumped in onsite landfills and ponds that eventually leaked into the groundwater. In addition to the types of wastes typically found at heavy industrial sites were wastewater from pot gas wet scrubbers used from about 1955 to 1980 that contained fluoride, along with spent potliner dumped into unlined landfills from about 1955 to 1980 that contained cyanide. With the smelter shut down permanently in fall 2009 and reduction pot emissions halted altogether, the focus for environmental watchdog groups and governmental regulators turned more to groundwater pollution that could possibly migrate off site to the Flathead River, drinking water wells at nearby residences or even the deep aquifer for the City of Columbia Falls drinking water supply.

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[1] For more information, see “Risk Assessment Guidance for Superfund, Human Health Evaluation Manual,” Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Jan. 18, 2007

[2] From an interview with a former Columbia Falls Aluminum Co. engineer on Dec. 4, 2013 [AL4404]

[3] U.S. Circuit Judge Raymond Randolph, United States Court of Appeals, For the District Court of Columbia Circuit, No. 96-1234, Columbia Falls Aluminum Company, et.al., petitioners, v. Environmental Protection Agency and Carol M. Browner, Administrator, Respondents Reynolds Metals Company, et.al., April 3, 1998 [AL3001]

[4] I. Rustad, K.H. Kastensen, K.E. Odegard, “Disposal options for spent potlining,” Waste Materials in Construction, 2000 [AL4917]

[5] For more information, see David L. Nelson and Michael M. Cox, David L., ”Lehniger Principles of Biochemistry,” 2000 and Jose Biller, ”Interface of neurology and internal medicine,” 2007

[6] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site Flathead County, Montana, United States Environmental Protection Agency Region 8,

Jan. 10, 2025, PDF file downloaded from Environmental Protection Agency website https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0800392, Docusign Envelope ID: 22CA78E0-BC60-49C1-97EC-5D6A1BEEBD45, page 351

[7] "Final Environmental Impact Statement, Direct Service Industry Options," U.S. Department of Energy, Bonneville Power Administration, April 1986 [AL4952]

[8] J. Granville Jensen, "The Aluminum Industry of the Northwest," November 1950 [AL2880]

[9] Mike Rogoway, "Vanalco draws buyout offer," The Vancouver Columbian, March 30, 2002 [AL3194]

[10] "Port of Vancouver (former Alcoa/Evergreen smelter) update," Washington Department of Ecology online, Aug. 26, 2011 [AL4316]

[11] "Returning sites to productive use, Alcoa smelter," Environmental Protection Agency online, May 1999 [AL3199]

[12] "Alcoa Vancouver," Washington Department of Ecology online, Aug. 5, 2011 [AL4164]

[13] Gretchen Fehrenbacher, "Aluminum all but gone; An idled Vancouver plant is likely to stay that way, reflecting a hurting U.S. industry," The Vancouver Columbian, Feb. 24, 2003 [AL3327]

[14] "Alcoa Vancouver consent decree monitoring plan amendments," Washington Department of Ecology online, July 2003 [AL3617]

[15] Allan Brettman, "Evergreen aluminum plant awaits new uses," The Oregonian, Sept. 29, 2005 [AL4163]

[16] Washington Department of Ecology online, Aug. 26, 2011 [AL4316]

[17] "Terminal brings new jobs, business and rail to Port of Vancouver," Port of Vancouver online, Aug. 5, 2011 [AL4162]

[18] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site Flathead County, Montana, United States Environmental Protection Agency Region 8, Jan. 10, 2025, page 350, see also Washington Department of Ecology, Periodic Review Report, Alcoa Vancouver Facility Site ID#: 21, 5701 NW Lower River Road, Vancouver, WA 08660, prepared by the Industrial Section, Waste 2 Resources Program, Department of Ecology, June 2015; and Washington Department of Ecology, Cleanup Action Plan, Alcoa Vancouver Potliner, National Priorities List Site, Vancouver, Washington, February 1992, Washington Department of Ecology

[19] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site Flathead County, Montana, United States Environmental Protection Agency Region 8, Jan. 10, 2025, page 351

[20] "CreditNews Aug. 10 - McCook Metals LLC," The U.S. Business Journal online, Aug. 10, 2001 [AL3181] and "Draft Cleanup Action Plan, Former Reynolds Metals Reduction Plant - Longview, Cowlitz County, Washington," Washington Department of Ecology, August 2018 [AL5648]

[21] "Before the Board of Environmental Review of the State of Montana, Notice of Adoption, In the matter of the adoption of New Rule I pertaining to maintenance of air pollution control equipment for existing aluminum plants," Montana Administrative Register online, Aug. 15, 2002 [AL3463] and Washington Department of Ecology, August 2018 [AL5648]

[22] Pat Forgey, "Smelter cleanup may pour jobs, dollars into town," Longview Daily News, Jan. 25, 2004 [AL3526]

[23] Pat Forgey, "Bidders eye smelter's remnants," Longview Daily News, April 19, 2004 [AL3578]

[24] Pat Forgey, "Bidding farewell after smelter auction," Longview Daily News, April 23, 2004 [AL3579]

[25] Eric Apalategui, "Lime importer covets smelter site," Longview Daily News, July 7, 2004 [AL3615]

[26] Apalategui, July 7, 2004 [AL3615]

[27] "Demolition and cleanup accomplishments at the former Reynolds Longview reduction plant," Washington Department of Ecology online, June 2011 [AL4166] and Washington Department of Ecology, August 2018 [AL5648]

[28] Washington Department of Ecology online, June 2011 [AL4166]

[29] Washington Department of Ecology online, June 2011 [AL4166]

[30] Amy Fischer, "Owners of former Reynolds plant shift focus to below-ground contamination," Longview Daily News, Nov. 23, 2008 [AL4227] and Erik Olson, "Alcoa plan for Reynolds cleanup completion coming next year," Longview Daily News, Aug. 4, 2011 [AL4165] and Forgey, Jan. 25, 2004 [AL3526]

[31] Eric Olson, "Alcoa to finish cleanup plan for former Reynolds plant," Longview Daily News, June 29, 2011 [AL4198]

[32] Washington Department of Ecology, August 2018 [AL5648]

[33] Washington Department of Ecology, August 2018 [AL5648]

[34] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site Flathead County, Montana, United States Environmental Protection Agency Region 8, Jan. 10, 2025, page 352, see also Washington Department of Ecology, Draft Cleanup Action Plan, Former Reynolds Metals Reduction Plant – Longview, Cowlitz County, Washington, August 2002

[35] "Kaiser Aluminum – Mead works potliner superfund cleanup site," Washington Department of Ecology online, January 2001 [AL3122]

[36] "Kaiser Aluminum Mead Works," Environmental Protection Agency online, April 2001 [AL3121]

[37] Environmental Protection Agency online, April 2001 [AL3121]

[38] "Kaiser Aluminum, Mead Works," Environmental Protection Agency, EPA Superfund site reports, 1982 [AL4104] and "NPL site narrative for Kaiser Aluminum Mead works," Environmental Protection Agency online, Sept. 8, 1983 [AL3476]

[39] AP, "Kaiser agrees to clean up some polluted land," Spokane Spokesman-Review, Aug. 12, 2004 [AL3853]

[40] John Stucke, "Kaiser gives up on Mead smelter," Spokane Spokesman-Review, Jan. 14, 2003 [AL4171]

[41] "Newstrack, Kaiser Aluminum Corp. bankruptcy," Spokane Spokesman-Review, Nov. 17, 2003 [AL3473]

[42] John Stucke, "Kaiser selling land near Mead smelter, Douglass has offered $1.23 million for two parcels," Spokane Spokesman-Review, Oct. 21, 2003 [AL3474]

[43] Spokane Spokesman-Review, Aug. 12, 2004 [AL3853]

[44] "Kaiser Aluminum – Mead Works Potliner Superfund Cleanup Site, Draft Consent Decree," Washington Department of Ecology online, August 2004 [AL4174]

[45] Spokane Spokesman-Review, Aug. 12, 2004 [AL3853]

[46] "Kaiser Aluminum reaches agreement to sell Mead, Washington, smelter, buyer to focus on possible restart of anode operation," Kaiser online, Feb. 26, 2004 [AL3538]

[47] "Business briefs, Industry, Kaiser to sell aluminum smelter for $7.4 million," The Olympian online, April 10, 2004 [AL3852]

[48] AP, "Kaiser smelter sale dims hope of restart," Vancouver Columbian, April 10, 2004 [AL4172]

[49] Paul Read, "Salvaging an idle smelter, St. Louis concern well along in dismantling Kaiser's Mead Works, looks to future uses," Spokane Journal of Business, Nov. 10, 2004 [AL3848]

[50] "Ormet signs agreement to purchase carbon anode facility," Ormet Corp. online, March 30, 2010 [AL4194]

[51] Kim Crompton, "Part of Kaiser plant may reopen," Northwest Business Press Inc., May 20, 2010 [AL4195]

[52] "Ormet announces anode facility update," Ormet Corp. online, Dec. 3, 2010 [AL4196]

[53] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site Flathead County, Montana, United States Environmental Protection Agency Region 8, Jan. 10, 2025, page 350, reference to Hydrometrics. 2018. Supplemental Feasibility Study Report, for Kaiser Mead NPL Site. Prepared for the Mead Custodial Trust by Hydrometrics, Inc., October 2018

[54] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site, page 404

[55] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site, page 405

[56] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site, page 412

[57] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site, page 412

[58] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site, page 352

[59] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site, page 352

[60] "Port of Tacoma demolishes landmark Kaiser smokestack on July 2, 2006," Port of Tacoma online, July 25, 2008 [AL4197]

[61] AP, "Kaiser closing Wash. plant for 2 weeks," Midland Daily News online, Dec. 20, 2002 [AL3300]

[62] "Kaiser selling Washington facility," Houston Business Journal, Dec. 20, 2002 [AL3299]

[63] "Agreement reached: Port announces contract to purchase Kaiser property," Port of Tacoma online, Dec. 19, 2002 [AL4180]

[64] Forgey, Jan. 25, 2004 [AL3526]

[65] "One Tideflats landmark down, one alumina dome to go," Washington Ports online, Feb. 1, 2005 [AL3874]

[66] "Port contractors to start wharf construction," Port of Tacoma online, Aug. 29, 2007 [AL4181]

[67] Port of Tacoma online, July 25, 2008 [AL4197]

[68] "Boom possible this morning from work on former Kaiser Tideflats site," Port of Tacoma online, Nov. 25, 2009 [AL4182]

[69] "Cleaning up the land," Port of Tacoma online, Aug. 23, 2011 [AL4186]

[70] "Port of Tacoma intends to dispute threatened EPA paperwork penalty," Port of Tacoma online, Feb. 22, 2010 [AL4184]

[71] Port of Tacoma online, Feb. 22, 2010 [AL4184]

[72] "Port of Tacoma settles EPA paperwork dispute for $137,000," Port of Tacoma online, Aug. 19, 2010 [AL4185]

[73] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site, page 224, see also Port of Tacoma, Final SPL Area Interim Action Work Plan, Former Kaiser Aluminum Property, 3400 Taylor Way, Tacoma, Washington, prepared for Port of Tacoma by Landau Associates, January 2013; and Washington Department of Ecology, Ecology Cleanup Action Plan, Former Kaiser Aluminum Property, 3400 Taylor Way, Tacoma, Washington, Department of Ecology, June 2016

[74] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site, page 350

[75] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site, page 352

[76] "Alcoa begins Troutdale aluminum smelter restoration," Aluminum Association online, July 16, 2003 [AL3414]

[77] "Proposed plan for source areas and groundwater interim action, Reynolds Metals superfund site," Environmental Protection Agency online, August 2002 [AL3417]

[78] Environmental Protection Agency online, August 2002 [AL3417]

[79] "Public health assessment, Reynolds Metals Company, Troutdale, Multnomah County, Oregon," U.S. Centers for Disease Control, Jan. 14, 1997 [AL3527]

[80] "Alcoa begins Troutdale aluminum smelter restoration," Alcoa press release, Aluminum Association online, July 16, 2003 [AL4167]

[81] "Tetra Tech to manage cleanup of former Troutdale facility," Alcoa online, Sept. 26, 2003 [AL3525]

[82] Pat Forgey, Jan. 25, 2004 [AL3526]

[83] "Projects," TetraTech online, 2011 [AL4168]

[84] Michael Andersen, "Oregon: Cleaned-up Reynolds Metals site in Troutdale sprouts promise," The Oregonian, April 22, 2011 [AL4229]

[85] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site, page 353

[86] Chief Judge James M. Burns, Orchard View Farms Inc. v. Martin Marietta Aluminum, Civ. No. 71-222, 550 F. Supp. 984 (1980), United States District Court, D. Oregon, March 28, 1980 [AL5061]

[87] Bonneville Power Administration's Service to Direct Service Industrial (DSI) Customers for Fiscal Years 2007-2011, Administrator's Record of Decision, June 30, 2005 [AL4405]

[88] "Martin Marietta Aluminum Co., Oregon, EPA ID #ORD052221025, Site description," Environmental Protection Agency Region 10 online, September 2007 [AL5009]

[89] Douglas MacCourt, "Industrial revitalization is a key part of sustainability," Sustainable Business Oregon online, Oct. 6, 2010 [AL4187]

[90] Ross Courtney, "The Goldendale aluminum plant – The death of a way of life," Yakima Herald online, April 9, 2011 [AL4169]

[91] "Northwest Aluminum Specialties acquires new financing," Aluminum Association online, Aug. 9, 2007 [AL3982]

[92] RaeLynn Ricarte, "Sapa buys NW Aluminum Specialties," The Dalles Chronicle, Sept. 22, 2015 [AL5244]

[93] "Sapa acquires aluminum casting plant, enhancing its capabilities in the Pacific Northwest," Sapagroup online, Sept. 22, 2015 [AL5243]

[94] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site, page 349, see also Environmental Protection Agency, Record of Decision, Martin-Marietta Aluminum Co., The Dalles, Oregon, September 1988

[95] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site, page 351

[96] U.S. Centers for Disease Control, Jan. 14, 1997 [AL3527]

[97] Patricia A. Plunkert, "Aluminum," U.S. Geological Survey online, 1995 [AL2949]

[98] "Northwest Aluminum Company Brief History," Northwest Aluminum Co. online, May 5, 1998 [AL0659]

[99] "On site releases 1988-2003 former Goldendale Aluminum Co. Klickitat County, Wash.," Golden Northwest Co., May 19, 2015 [AL4854]

[100] Bonneville Power Administration, June 30, 2005 [AL4405]

[101] Ross Courtney, April 9, 2011 [AL4169]

[102] "Going, going, gone?" Goldendale Sentinel, Feb. 16, 2011 [AL4200]

[103] "Aluminum smelter demolition, Goldendale, Washington," Magnus Pacific online, June 2011 [AL4201]

[104] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site, page 353

[105] George David Smith, "From monopoly to competition, The transformations of Alcoa, 1888-1986," 1988 [AL1284]

[106] William H. Rodgers Jr., "Corporate country: A state shaped to suit technology," 1973 [AL3420]

[107] William H. Rodgers Jr., "Aluminum industry and fluoride 'science,'" Fluoride Action Network online, 1973 [AL5015]

[108] "Dept. of Ecology Public Notice of Draft Permit," Washington Department of Ecology, 1997 [AL4094]

[109] Kie Relyea, "Alcoa to buy Alumax," Bellingham Herald, March 10, 1998 [AL0062]

[110] Harriet King, "BPA signs contracts subsidizing three smelters in U.S. Northwest," Platt's Metals Week, June 29, 2006 [AL3954]

[111] "Timeline: 50 years at Alcoa Intalco Works," Bellingham Herald, Aug. 14, 2015 [AL5283]

[112] Bellingham Herald, Aug. 14, 2015 [AL5283]

[113] Jason Taylor, "Alcoa stays open… in Ferndale, Wenatchee union official frustrated," KPQ Newsradio online, May 4, 2016 [AL5284]

[114] Record of Decision for the Anaconda Aluminum Company Columbia Falls Reduction Plant Site, page 353, see also Washington Department of Ecology, Cleanup Action Plan, Intalco Landfill Closure Program, Ferndale, Washington, July 2006

[115] "Ormet Corp.," Environmental Protection Agency online, May 1999 [AL0648]

[116] Environmental Protection Agency online, May 1999 [AL0648]

[117] "Ormet Superfund Site," Environmental Protection Agency Region 5 online, Nov. 7, 2013 [AL4887]

[118] Jim Drew, "'Civil Action' lawyer takes on pollution, corruption at Ormet Aluminum," Toledo Blade, Nov. 5, 2000 [AL3585]

[119] Drew, Nov. 5, 2000 [AL3585]

[120] Reuters, “Ormet files reorganization plan in bankruptcy court,” Aluminum Association online, Sept. 2, 2004 [AL3637]

[121] “Partial curtailment of operations,” Ormet Corp. online, July 31, 2013 [AL4700]

[122] “Sale of Ormet Corporation to Smelter Acquisition LLC approved by bankruptcy court; Operations to continue without interruption,” Ormet Corp. online, June 4, 2013 [AL4699]

[123] “Full curtailment of Hannibal operations,” Ormet Corp. online, Oct. 4, 2013 [AL4701]

[124] “Ormet starts process to sell Hannibal aluminum smelter,” Ormet Corp. online, Feb. 15, 2014 [AL4702]

[125] John Milam, “Shutdown of Ohio aluminum giant Ormet appears final,” People’s World online, Aug. 5, 2014 [AL4888]

[126] For more information, see Casey Junkins, “Progress continues in Hannibal at former Ormet site,” The Intelligencer-Wheeling News-Register, June 15, 2016

[127] “Kaiser Aluminum maps big outlay, $280,000,000 expansion set to start in April, with plants in West Virginia, Louisiana, To raise capacity 50%, 40-year pact is made with American Gas subsidiary for power from coal,” New York Times, Dec. 5, 1955 [AL1210]

[128] “Giant aluminum rolling mill joins production line,” New York Times, May 30, 1958 [AL1227]

[129] Bob Regan, “Ravenswood stock offer may shed light on old debate,” American Metal Market, Aug. 10, 1995 [AL0117] and Century Aluminum Co (CENX) Annual Report (SEC form 10-K) Management’s Discussion and Analysis of Financial Condition and Results of Operations, from Edgar Online, March 30, 2000 [AL1308]

[130] “Ravenswood gone public,” Source News & Reports online, May 29, 1996 [AL0157]

[131] “Century sells assets to Pechiney, looking for more,” Platt’s Metals Week, Aug. 2, 1999 [AL0309]

[132] “Where we are today, Where we started, Our growth story,” Century Aluminum online, June 17, 2013 [AL4396]

[133] AP, “New info: New plan ordered for W.Va. Aluminum site cleanup,” WSAZ News Channel online, June 5, 2013 [AL5153]

[134] For more information, see Max Garland, “Century plant near Ravenswood could soon be sold, demolished,” Charleston Gazette-Mail, Dec. 14, 2016

[135] “Eastalco Aluminum sued over fluoride emissions,” Washington Post, Fluoride Action Network online, 1978-1983 [AL3422]

[136] Washington Post, Fluoride Action Network online, 1978-1983 [AL3422]

[137] See “Former Alcoa Eastalco Works, What you need to know,” Maryland Department of the Environment, June 2018

[138] Maryland Department of the Environment, June 2018

[139] Maryland Department of the Environment, June 2018

[140] Pamela Rigaux, “High amounts of fluoride reported in water at Eastalco,” Frederick News-Post online, Dec. 23, 2006 [AL4228]

[141] Ed Waters Jr., “Eastalco buildings to be demolished, no plans for property,” Frederick News-Post online, April 6, 2010 [AL4233]

[142] Bethany Rodgers, “Macro Report Blog: Eastalco property a candidate for manufacturing operation,” Frederick News-Post online, July 28, 2012 [AL4698]

[143] Maryland Department of the Environment, June 2018

[144] Guides to archives and manuscript collections at the library and archives at the Heinz History Center, Jan. 14, 2015 [AL5033]

[145] "On site releases 1988-2009 Massena East, former Reynolds Metals Co., Massena NY," Reynolds Metals Co, from United Steelworkers online, May 19, 2015 [AL4855]

[146] "Alcoa's Massena Operations," Alcoa online, Oct. 9, 2015 [AL4964]

[147] Ryne Martin, "Alcoa will permanently close Massena East, end smelting at West plant and lay off up to 500 workers," Watertown Daily Times, Nov. 2, 2015 [AL5297]

[148] "Aluminum Company of America, New York, EPA ID # NYD980506232, NPL listing history," Environmental Protection Agency online, Feb. 8, 2012 [AL4315]

[149] "EPA proposes cleanup plan for NY's Grasse River," WPTZ News Channel online, Oct. 2, 2012 [AL4314]

[150] "Give back the Yadkin, dammit," Independent Weekly online, Nov. 18, 2009 [AL4083]

[151] Patricia Plunkert, "Mineral Industry Surveys, Aluminum in June 2002," U.S. Geological Survey online, August 2002 [AL3418]

[152] Independent Weekly online, Nov. 18, 2009 [AL4083]

[153] Karissa Minn, "Alcoa seeks options for Badin works," Salisbury Post, Jan. 16, 2011 [AL4238]

[154] Independent Weekly online, Nov. 18, 2009 [AL4083]

[155] Reuters, "Update: Alcoa demolishing two plants, sees $120 mln charge," Reuters online, April 5, 2010 [AL4232]

[156] "Alcoa Badin works," Alcoa online, Nov. 10, 2011 [AL4236]

[157] Minn, Jan. 16, 2011 [AL4238]

[158] Minn, Jan. 16, 2011 [AL4238]

[159] For more information, see Josh Bergeron, "Residents oppose Alcoa's Badin Works permit," Salisbury Post, July 2, 2015

[160] AP, "NC environmental group tells Alcoa it plans to sue," Bloomberg Businessweek online, Nov. 9, 2011 [AL4239]