Chapter 62
Investigations and reactions

CFAC's potlines building was still standing and completion of the remedial investigation and feasibility study was perhaps four years away when Flathead residents learned about an industrial manufacturer interested in setting up business on the CFAC property. On Dec. 12, 2016, Rafael Minato and Irineu Minato, the owner and the chief financial officer of Brazilian-based Comtrafo S.A., came to Whitefish to meet with Andy Techmanski, of Whitefish Energy Holdings, to look at the CFAC site. Comtrafo had recently acquired 51% of Whitefish Energy Holdings, which was a service company for powerline construction, substation construction and environmental mitigation projects. The Minatos told local media that their company manufactured power transformers in Brazil for electrical utility companies and wanted to do the same in the Flathead Valley, starting with 250 employees and expanding to 1,000 at maximum market potential. The Minatos said they would be the only transformer manufacturer in the Pacific Northwest and the only plant in the region to manufacture 345-kilovolt power transformers. The three toured the CFAC site and then met with Columbia Falls City Manager Susan Nicosia and members of Montana West Economic Development, a quasi-government organization. Columbia Falls had seen a number of industrial jobs recently lost to plant closures, and Rep. Zinke's office had contacted Nicosia about the Comtrafo plant idea. [1]

Techmanski said he intended to develop a Montana Industrial Economic Development Initiative proposal and meet with Gov. Bullock in hopes of obtaining seed money grants, guaranteed bonds and tax breaks or tax credits. Techmanski said he needed to develop $20 million in transformer orders from regional utilities, such as Flathead Electric Cooperative Inc. and NorthWestern Energy, to raise the $40 million needed to get the plant built. So far, however, he had been unable to line up pre-orders – both Flathead Electric and NorthWestern Energy bid out transformer purchases, but NorthWestern had traveled to Brazil to meet with Comtrafo officials. Techmanski noted that an available workforce already existed in the Flathead Valley. "Montana needs some good job news, and we are trying to ignite that with our plans," he said. "We believe a lot of the core skills we need we can harness here in the valley… left over from the previous factory and plywood layoffs." Techmanski had contacted Glencore about the plant idea, CFAC environmental project manager John Stroiazzo told local media, but Comtrafo would face difficulties in developing the former smelter site into a manufacturing plant because of the Superfund designation. "He's got to blend in with the regulators," Stroiazzo said. If the CFAC site was not suitable, the project might continue at the Columbia Falls Industrial Park north of town near the CFAC site, the three suggested. [2]

About a year later, Whitefish Energy was back in the news – but it was not good and it was national in scope. On Oct. 23, 2017, it was reported in the Washington Post that the Whitefish electrical company had landed a $300 million contract with the Puerto Rico Electric Power Authority to repair electrical infrastructure damaged on Sept. 20, 2017 by Hurricane Maria. Whitefish Energy had only two employees on Sept. 20, and their largest contract to date was a $1.3 million agreement to repair a 4.8-mile long transmission line in Arizona. One month later, they had lined up the big contract with PREPA. By Oct. 23, Whitefish Energy reported having 280 workers in Puerto Rico and 700 more to come. The U.S. House Committee on Natural Resources began investigating the Puerto Rico contract between Whitefish Energy and PREPA, which was $9 billion in debt. The Whitefish Energy contract listed hourly wages as $330 for a site supervisor, $247 for a project manager and $228 for a lineman. Whitefish Energy representative Brandon Smulyan said the company was formed in 2015 and was intended to scale up and down as needed. There were also concerns about ties between Whitefish Energy and Ryan Zinke, Montana's former lone U.S. representative and now the Secretary of the Interior. Zinke's press secretary said the Zinkes and Technakskis knew each other previously "because they both live in a small town (population 6,000) where everyone knows everyone, and his son joined a friend who worked a summer job at one of their construction sites." [3]

Roux's data summary report

On Feb. 27, 2017, Roux Associates Inc. completed a 7,315-page draft Phase 1 Site Characterization Data Summary Report for CFAC's smelter site as part of the Superfund investigation process. The document was signed off by Michael Ritorto, the remedial investigation manager and principal hydrogeologist, and Andrew Baris, the remedial investigator/feasibility study manager, principal hydrogeologist and company vice president. The report was part of the Superfund site's Remedial Investigation/Feasibility Study that was being conducted pursuant to the Nov. 30, 2015, administrative settlement agreement and order on consent between CFAC and the EPA. The purpose of the report was to identify and/or confirm source areas and associated chemicals of potential concern outlined in the Remedial Investigation/Feasibility Study Work Plan. Another purpose was to provide a broad characterization of the hydrogeological conditions and the nature and extent of the contamination across the site. More specifically, the purpose of the report was to determine which areas and site features required further investigation and/or qualitative evaluation in the future Baseline Risk Assessment; refine the list of chemicals of potential concern that needed further investigation; refine the understanding of groundwater flow and groundwater quality beneath the plant site; develop a more detailed understanding of the bedrock topography and the depths, thicknesses and extents of the various hydrogeological units, both of which might influence groundwater flow and the distribution of chemicals of potential concern in the subsurface; and develop data to support the preparation of the Baseline Risk Assessment Work Plan. [4]

Activities that provided information for Roux's report included additional historical records review; site reconnaissance, geophysical surveying by electrical resistivity/induced polarization survey, landfill and passive soil gas surveying, soil sampling from site drainage structures, site-wide soil borings and soil sampling, incremental soil sampling within the operational area, test pits and soil sampling within the borrow pit area, ground-penetrating radar surveying of the landfills, test pits within the asbestos landfills, monitoring well installation, development and gauging, groundwater and surface water sampling, sediment sampling, data verification and validation activities, and a screening level ecological risk assessment. All laboratory work was conducted by Test America Laboratories Inc. of Edison, N.J. Laboratory data was reviewed by Laboratory Data Consultants Inc. of Carlsbad, Calif. Spectrum Geophysics, a subcontractor, conducted the electrical resistivity/induced polarization survey across six transects of the plant site from April 18-22, 2016, to develop a preliminary understanding of approximate depth to bedrock, approximate depth to groundwater, approximate depth of landfills, potential changes in subsurface hydrogeological conditions and potentially other subsurface anomalies. [5]

Roux conducted soil gas, landfill soil gas and passive soil gas surveys from April 18-25, 2016, to assess the potential for methane or volatile organic compounds at the Former Drum Storage Area (for hazardous wastes), the Operational Area and five landfill sites. Roux also took sediment samples from four drainage structures that could be readily accessed. Under Roux and Hydrometrics oversight, Cascade Drilling of Federal Way, Wash., made 124 soil borings from May 18 to Aug. 31, 2016, and collected 419 soil samples in the vicinity of various site features. The soil boring samples were taken from various depths and tested for volatile and semi-volatile organic compounds, metals, PCBs, pesticides, total cyanide, fluoride and lead. They also sampled soil in the rectifier switchyards for two chemicals that result from the breakdown of PCBs – polychlorinated dibenzo-pdioxins and polychlorinated dibenzofurans. [6]

The 43-acre Operational Area was defined based on historical aerial photos and then divided into 42 one-acre grid cells for soil investigations. Thirty-two grab samples were taken from two feet below the surface at each cell and tested for volatile and semi-volatile organic compounds, metals, PCBs, pesticides, total cyanide and fluoride. For comparison purposes, Cascade Drilling conducted background soil investigations from April 18-19, 2016, in an open field west of the plant site where aerial photos from the 1940s showed an unforested area with no evidence of industrial operations. Watson

Excavating performed test pit excavations at the borrow pit area in the southeastern portion of the plant site, where CFAC had established a state-permitted open-cut mine for use by Calbag Resources as a source of fill material for the plant demolition contract. Shari A. Johnson & Associates Engineering used ground-penetrating radar at the landfills to determine the presence of cap material and the thickness and uniformity of the cap. Ten transects were made across five landfills. Cascade Drilling dug test pits in the asbestos landfills which were inspected by Hydrometrics. Cascade Drilling installed 44 monitoring wells from May 18 to Aug. 31, 2016, including 28 water table monitoring wells and 16 deeper monitoring wells. The water table wells were drilled five to 10 feet below observable groundwater at the time of drilling, and 2-inch PVC casing was installed and grouted. An extra step was taken to prevent the deep wells from causing cross-contamination between the upper groundwater system and the deeper hydrogeological units by using a double casing. [7]

Roux measured site-wide groundwater levels on Aug. 30, 2016 and Nov. 29, 2016. Groundwater sampling took place on Sept. 9-21, 2016, with samples tested for dissolved metals, total cyanide, fluoride, alkalinity, hardness, nutrients including chloride and sulfate, and total dissolved solids. Samples from wells near potential sources were tested for volatile and semi-volatile organic compounds. Groundwater levels and samples were to be tested on a quarterly basis for a year. Ten surface water samples were collected from June 6-7, 2016, from surface waters that were expected to dry out later in the summer, including three locations in the South Percolation Ponds along the Flathead River, five locations in the Cedar Creek Reservoir Overflow Ditch on the east side of the plant, and two locations in the north end of the plant site where surface water was observed. No surface water was observed in the North and Northeast Percolation Ponds, so no samples were collected there. Surface water samples were also taken from Cedar Creek, the Flathead River and the Backwater Seep Sampling Area, which was along the river downstream from the South Percolation Ponds. Surface water samples were tested for temperature, conductivity, pH, turbidity, dissolved oxygen, oxygen reduction potential, metals, cyanide, fluoride, alkalinity, hardness, nutrients including chloride and sulfate, total dissolved solids, and volatile and semi-volatile organic compounds. Sediment samples were taken on Aug. 29 and on Sept. 6-9, 2016, from the same locations as surface water samples and also at the North and Northeast Percolation Ponds. [8]

An initial evaluation of site conditions based on prior investigations formed the basis for development of a preliminary conceptual site model presented in the Remedial Investigation and Feasibility Study Work Plan. The preliminary conceptual site model included discussion of potential contaminants of potential concern and potential source areas, as well as potential migration and exposure pathways for contaminants of potential concern. The preliminary conceptual site model identified the following site features as potential source areas – landfills, including the closed Wet Scrubber Sludge Pond and the closed leachate ponds; the Former Drum Storage Area; percolation ponds; waste and raw materials storage and handling areas; the plant drainage system, including drywells and associated discharge points; and the underground and above-ground storage tanks. The area of elevated cyanide and fluoride concentrations in groundwater within the upper hydrogeological unit appeared to originate immediately to the west of Wet Scrubber Sludge Pond, where concentrations of both cyanide and fluoride exceeded 5,000 micrograms per liter. Based upon the southwest groundwater flow direction beneath this area of the site, this area of maximum concentrations was immediately downgradient of the West Landfill and Wet Scrubber Sludge Pond. According to Roux, this indicated that these two site features were the primary source of the elevated cyanide and fluoride concentrations in groundwater, which would be consistent with the historical use of these features as disposal locations for wastes containing cyanide and fluoride (cyanide-contaminated spent potliner was placed in the West Landfill, and calcium fluoride sludge from the wet scrubbers used from 1955 to the late 1970s was placed in the Wet Scrubber Sludge Pond). Roux also acknowledged that both of these landfills were unlined, and the engineered clay cap over the West Landfill was not installed until 1995. [9]

The cyanide and fluoride concentrations in groundwater to the east and northeast of the West Landfill and Wet Scrubber Sludge Pond, and immediately downgradient of the former Sanitary Landfill, Center Landfill and East Landfill (and its associated leachate ponds) were orders of magnitude lower than those described above. According to Roux, those findings suggested that the Sanitary, Center and East landfills were not contributing sources to the cyanide and fluoride in groundwater. Adjacent to the West Landfill, Roux found that groundwater elevations in the upper hydrogeological unit could fluctuate more than 50 feet seasonally, which indicated the potential for groundwater to rise above the base of the West Landfill. Roux noted that groundwater elevation fluctuations would continue to be monitored and be further evaluated. Soil samples collected from locations immediately adjacent to the landfill contained concentrations of contaminants of potential concern, including cyanide, fluoride and polycyclic aromatic hydrocarbons. However, with exception of the Former Drum Storage Area, the concentrations of these contaminants of potential concern in soil adjacent to the landfills were generally similar to or less than those observed in other areas of the site, such as the Operational Area or around the Main Plant. Based upon the similarity of concentrations to other site areas, and the site reconnaissance documenting established vegetative covers across the landfills, it did not appear that the landfills in their current state were the source of the contaminants of potential concern detected in soil, Roux noted. Instead, the soils around the landfills likely were impacted by the historical waste-handling practices around the landfills and by aerial deposition of contaminants of potential concern from historical plant emissions. [10]

Based upon the Site Characterization findings, the Former Drum Storage Area located immediately to the west of the Wet Scrubber Sludge Pond also could be a contributing source to the elevated cyanide and fluoride concentrations in the site's groundwater. The percolation ponds were identified as potential sources within the preliminary conceptual site model in the Remedial Investigation and Feasibility Study Work Plan because of their use as wastewater discharge locations and based upon the prior sampling conducted during the EPA Site Reassessment in 2013. The results of the Phase I Site Characterization indicated the Northeast Pond and its influent ditch typically contained the among the highest concentrations of cyanide and polycyclical aromatic hydrocarbons in the soil and sediment, followed by the effluent ditch, the Northwest Pond and the West Pond. The concentrations of contaminants of potential concern decreased with increasing depth beneath the ponds. The Northeast Percolation Pond and West Percolation Pond were located hydraulically downgradient of the West Landfill and Wet Scrubber Sludge Pond source area. Roux reported that the continued decrease in concentrations as groundwater flowed beneath the ponds suggested that, currently, the ponds were not a significant source of the cyanide and fluoride concentrations observed in groundwater, because if the ponds were a significant source, an increase in cyanide and fluoride concentrations would be expected. Additionally, semi-volatile organic compounds (coal tar pitch and petroleum coke constituents) were not detected in any groundwater monitoring wells immediately downgradient from the Northwest Percolation Pond or the Northeast Percolation Pond, which suggested these two percolation ponds effectively prevented migration of semi-volatile organic compounds from the ponds to the groundwater, Roux noted. [11]

The various areas where waste and raw materials were stored and handled during historical site operations, as well as the plant drainage system and various underground and above-ground storage tanks located on the north side of the Main Plant, had been identified as potential source areas within the preliminary conceptual site model. Sampling in the Main Plant area also included along railroad sidings that accessed the site, the Rod Mill to the southwest of the Main Plant, and the Operational Area located to the north between the Main Plant and landfill area. The findings from the Phase I Site Characterization indicated that concentrations of cyanide and fluoride in soil were detected throughout these areas, Roux noted. However, the concentrations were below the EPA's industrial regional screening levels at all locations and residential regional screening levels at all locations with the exception of two – cyanide was present above the residential regional screening level in a soil boring beneath the former Cathode Soaking Pit just north of the Main Plant building, and fluoride was detected in a soil boring just east of the Main Plant at a concentration exceeding the residential regional screening levels. Polycyclic aromatic hydrocarbons exceeded industrial regional screening levels in surface soil and shallow soil across the majority of the area surrounding both the Main Plant and Paste Plant, and across the Operational Area. The widespread distribution of polycyclic aromatic hydrocarbons was attributed to the extensive handling and storage of polycyclic aromatic hydrocarbon-containing materials, such as petroleum coke and coal tar pitch, which were key components of the manufacturing process for carbon anodes, as well as the aerial deposition of polycyclic aromatic hydrocarbons from historical plant emissions. [12]

Contaminants of potential concern

According to Roux's draft report, cyanide, fluoride and polycyclic aromatic hydrocarbons were the primary contaminants of potential concern found within the various source areas and/or site features investigated for the draft Phase 1 Site Characterization Data Summary Report, and the findings were consistent with the preliminary conceptual site model presented in the Remedial Investigation and Feasibility Study Work Plan. Roux noted that cyanide concentrations measured in all media at the site were based upon a total cyanide analysis; however, the screening levels developed by the EPA and utilized in the risk assessment process were based upon exposure to free cyanide. Prior studies of spent potliner leachate had documented that cyanide at aluminum smelter sites existed primarily in the form of iron-cyanide complexes. Typically, ferrocyanide and ferricyanide were more stable in the environment and tended not to release free cyanide and were less bio-available, Roux noted. Thus, any potential for effects due to cyanide exposure was likely overestimated, as free cyanide would only comprise a fraction, if any, of the total cyanide present. Roux noted that free cyanide analysis would be included in future sampling events to address this uncertainty and allow for more accurate assessment of potential risks. [13]

Volatile organic compounds were frequently detected in soil samples across the site. Acetone was detected in more than 95% of the soil samples, and four petroleum-related volatile organic compounds (benzene, toluene, ethylbenzene and xylenes, together known as BTEX) were detected in 34% of the soil samples. However, no volatile organic compound concentrations exceeded industrial or residential regional screening levels in any of the soil samples collected. Roux noted that there was no known source of acetone at the site. The widespread occurrence of acetone in soil was discussed with Test America laboratory, and it was suggested that the low levels of acetone detected in soil samples may have resulted from the sodium bisulfate preservative reacting with organic material in the sample. The widespread distribution of petroleum-based volatile organic compounds across the site was somewhat similar to that of polycyclic aromatic hydrocarbons. The frequent detection of petroleum-related volatile organic compounds at trace levels in soil was likely attributed to the presence of these volatile organic compounds, albeit at low concentrations, in the petroleum coke and coal tar pitch materials used at the site and were the primary sources of polycyclic aromatic hydrocarbons at the site. [14]

Although there were frequent detections of volatile organic compounds in soil, they were found infrequently in groundwater at the site. For example, acetone was detected in only 5% of the groundwater samples and BTEX in only 3%. In addition, there were no detections of volatile organic compounds at concentrations exceeding the EPA's tap water standard. Collectively, these findings suggested that volatile organic compounds did not need to be retained as contaminants of potential concern; however, this would be further evaluated during preparation of the Baseline Risk Assessment Work Plan, Roux noted. The results of the background sampling and statistical data analysis indicated that many of the metal concentrations observed in soil samples were likely a result of metals present at background concentrations. However, the areal distribution of metal detections and the magnitude of metal concentrations around certain site features indicated that some metals might also be present as a result of the former operations, Roux noted. For example, select metals were present in higher concentrations within the North Percolation Ponds and the ditch connecting the two ponds when compared to the other areas of the site. [15]

The determination of which metals should be retained as contaminants of potential concern for subsequent phases of the remedial investigation and the risk assessment would be made based upon data evaluation during preparation of the Baseline Risk Assessment Work Plan, Roux noted. The site-wide soil data for pesticides and PCBs indicated no detections of either set of compounds in any of the site-wide soil samples. These data indicated that PCBs and pesticides were not likely a contaminant of concern in soil site-wide, but PCBs were detected in four areas of the Operational Area and would be further evaluated in preparation of the Baseline Risk Assessment Work Plan, Roux noted. The report also included analysis for dioxins and dibenzofurans in soil samples collected from the Rectifier Yards south of the Main Plant. These analyses were specified due to the historical occurrence of transformer fires within these areas and the potential for these compounds to be generated as combustion by-products from PCBs. Although dioxin and dibenzofuran type compounds were detected, the evaluations indicated that none of the concentrations exceeded the calculated residential or industrial regional screening levels at any sampling interval. These findings suggested that dioxins and dibenzofurans did not need to be retained as contaminants of potential concern; however, this would be further evaluated during preparation of Baseline Risk Assessment Work Plan, Roux noted. [16]

Hydrogeology and groundwater sampling

As part of Roux's draft Phase 1 Site Characterization Data Summary Report, four generalized hydrogeological cross-sections of the plant site were created depicting the stratigraphy beneath the site – southwest to northeast and perpendicular to Teakettle Mountain across the West Landfill; west to east across the southern portion of the site; northwest to southeast and parallel to Teakettle Mountain from the Industrial Landfill to the Flathead River; and west to east across the Former Drum Storage Area, Wet Scrubber Sludge Pond and the East Landfill. From highest to lowest, the three stratigraphic units underlying the plant site consisted of 1) a layer of glaciofluvial and alluvial coarse-grained soils varying in vertical extent; 2) a layer of dense, poorly-sorted glacial till with interbedded deposits of glaciolacustrine clays and silts; and 3) bedrock. The top layer averaged 50 to 80 feet thick below the Main Plant area and from 125 to 150 feet thick below the Former Drum Storage Area, West Landfill, Wet Scrubber Sludge Pond and Center Landfill. The top layer reached about 100 feet thick near the Flathead River. The thickness of the second layer in the north, west and south portions of the site was not known because drilling did not reach the bottom, so it was assumed to be at least 200 feet thick, Roux noted. The depth to the third layer, pre-Cambrian aged bedrock, was believed to increase in a southwestern direction cross the site. The groundwater in the highest layer, referred to as the upper hydrogeological unit, appeared to be a perched water table. The saturation thickness of this top layer extended down to the second layer, with less saturation closer to Teakettle Mountain. [17]

Wells located near Teakettle Mountain typically went dry in late summer or early fall as a result of seasonal fluctuation in groundwater tables. Using 44 new and 20 existing monitoring wells, depth to groundwater was measured across the site on Aug. 30 and Nov. 29, 2016. Overall groundwater flow was found to be generally in the south or southwest direction toward the Flathead River, but the hydraulic gradient could be divided into three distinct areas – 1) steep near Teakettle Mountain and the landfills; 2) relatively flat in the center of the plant site, near the North Percolation Ponds, Operational Area and northern half of the Main Plant Area; 3) increasingly steep again between the BNSF Railway tracks and the Flathead River. This overall pattern suggested that the upper hydrogeological unit discharged into the Flathead River, which matched observations of the Backwater Seep Sampling Area along the river and downstream from the South Percolation Ponds, Roux noted. Deep-well sampling indicated that the separation between the second layer of glacial till and the upper hydrogeological unit was typically greater than 25 feet, indicating that there was limited if any hydraulic connectivity between the two main water-bearing zones, Roux noted. The elevations of groundwater in the deep wells varied by as much as 50 feet from the landfill areas to near the Flathead River, indicating a non-heterogeneous water table in the second layer. [18]

A review of transducer data indicated that water levels in the upper hydrogeological unit were highest in late May and early June and lowest in late October and early November. Data suggested that the Cedar Creek Reservoir Overflow Ditch, which flowed across the site's eastern area near Teakettle Mountain, likely contributed to recharging the groundwater at the plant site. Likewise, Cedar Creek was believed to be recharging groundwater on the west side of the plant site. The overflow ditch was dry during most of the time that investigations were underway, indicating a seasonal impact. [19] According to Columbia Falls City Manager Susan Nicosia, the reservoir's overflow ditch was built in the 1960s as part of a flood control program for the city of Columbia Falls, so much of Cedar Creek was diverted to an outfall in the Flathead River upstream from the plant closer to Bad Rock Canyon. Nicosia said the city was aware of leaks in the overflow ditch caused by gopher holes and tree roots, and city officials had been in talks with CFAC about the matter for some time. She also said she'd seen pipes installed near the ditch that apparently routed runoff from Teakettle Mountain around the overflow ditch. [20] On July 17, 2017, the Columbia Falls City Council took a look at its preliminary budget, which included an $80,000 line item to repair the overflow ditch. City Councilor Mike Shepard later commented that in addition to gopher holes and tree roots, a "big badger hole" had been found in the side of the ditch. [21]

Roux Associates noted in its report that groundwater samples were analyzed and compared to DEQ's Human Health Standards and the EPA's Maximum Contaminant Levels. Total cyanide was detected in 75% of the groundwater samples. Total cyanide was detected in the upper hydrogeological unit at concentrations greater than the DEQ and EPA standards of 200 micrograms per liter in 21 samples taken from monitoring wells primarily located downgradient of the West Landfill and Wet Scrubber Sludge Pond. Total cyanide did not exceed the DEQ and EPA standards in any groundwater samples from monitoring wells screened below the upper hydrogeological unit. Fluoride was detected in 95% of the groundwater samples. Fluoride was detected in the upper hydrogeological unit at concentrations greater than the DEQ and EPA standards of 4,000 micrograms per liter in seven groundwater samples from monitoring wells primarily located downgradient of the West Landfill and Wet Scrubber Sludge Pond. Fluoride did not exceed DEQ and EPA standards in any groundwater samples from monitoring wells screened below the upper hydrogeological unit. [22]

Metals that were frequently detected in site-wide soil were detected at a limited frequency in groundwater, including arsenic, aluminum, cobalt and iron. Arsenic was detected in the upper hydrogeological unit at concentrations exceeding the DEQ and

EPA standards of 10 micrograms per liter in two monitoring wells. Barium was detected below the upper hydrogeological unit at concentrations exceeding the DEQ standard of 1,000 micrograms per liter and the EPA standard of 2,000 micrograms per liter in one monitoring well. Semi-volatile and volatile organic compounds had limited detections in groundwater samples (less than 15%), and did not exceed DEQ and EPA standards in any groundwater samples, including at the areas within the Former Drum Storage Area and Operational Area where volatile organic compounds were detected in passive soil gas samples. Groundwater samples were also compared to the EPA's tap water regional screening level. Total cyanide was detected in the upper hydrogeological unit at concentrations exceeding the tap water standard of 0.15 micrograms per liter in 91% of groundwater samples from monitoring wells, but only two of 13 (15%) of groundwater samples from monitoring wells screened below the upper hydrogeological unit. The maximum concentration of cyanide in groundwater below the upper hydrogeological unit was 5.9 micrograms per liter. Fluoride was detected in the upper hydrogeological unit at concentrations exceeding the tap water standard of 80 micrograms per liter in 94% of groundwater samples from monitoring wells, but in only one (8%) of groundwater samples from monitoring wells screened below the upper hydrogeological unit. Metals including antimony, arsenic, barium, cobalt, iron, selenium and vanadium were detected at concentrations greater than the tap water standard. Semi-volatile and volatile organic compounds were not detected above the standard, with the exception of 1,2-dichloroethane in one groundwater sample. [23]

Groundwater sampled from the northern-most monitoring well at the site was used to compare up-gradient background groundwater quality. Total cyanide was detected in the upper hydrogeological unit at concentrations exceeding the concentration measured in this northern-most well (2.4 micrograms per liter) in 39 of the groundwater samples (83%) from monitoring wells, but only 1 of 13 (8%) of groundwater samples from monitoring wells screened below the upper hydrogeological unit. The maximum concentration of cyanide in groundwater below the upper hydrogeological unit was 5.9 micrograms per liter. Fluoride was detected in the upper hydrogeological unit at concentrations exceeding the concentration measured in this northern-most well (91.7 micrograms per liter) in 91% of groundwater samples from monitoring wells and eight of 13 groundwater samples (62%) from monitoring wells screened below the upper hydrogeological unit. Metals including sodium, potassium, magnesium, iron and manganese were detected in the upper hydrogeological unit at concentrations greater than those measured in this northern-most well in more than 50% of groundwater samples from monitoring wells. Metals including sodium, potassium, magnesium and aluminum were detected below the upper hydrogeological unit at concentrations greater than those measured in this northern-most well in more than 50% of groundwater samples from monitoring wells. [24]

Cyanide was detected in 91% of the groundwater samples collected from wells screened in the upper hydrogeological unit and 15% of groundwater samples collected from wells screened below the upper hydrogeological unit. The greatest concentrations of cyanide (greater than 10 times the DEQ and EPA standards of 200 micrograms per liter) in the upper hydrogeological unit were detected immediately downgradient of the West Landfill and Wet Scrubber Sludge Pond, with concentrations ranging from 2,060 micrograms per liter to 7,320 micrograms per liter. Cyanide concentrations in the upper hydrogeological unit decreased with increasing distance away from the West Landfill and Wet Scrubber Sludge Pond. Cyanide concentrations below the upper hydrogeological unit were non-detect in samples from 11 of 13 monitoring wells. Cyanide concentrations were non-detect in all groundwater samples from monitoring wells bordering the western boundary of the site in the vicinity of Aluminum City. [25]

Fluoride was detected in the upper hydrogeological unit in 98% of groundwater samples and below the upper hydrogeological unit in 85% of groundwater samples. Similar to cyanide, the highest concentrations of fluoride exceeding the DEQ and EPA standards of 4,000 micrograms per liter were detected immediately downgradient of the West Landfill and Wet Scrubber Sludge Pond, with concentrations ranging from 8,300 micrograms per liter to 38,400 micrograms per liter. Concentrations of fluoride in the upper hydrogeological unit also exceeded the DEQ and EPA standards in two monitoring wells located just north of the Main Plant Area. Similar to cyanide, fluoride concentrations in the upper hydrogeological decreased in monitoring wells with increasing distance away from the West Landfill and Wet Scrubber Sludge Pond. Fluoride concentrations below the upper hydrogeological unit were typically an order of magnitude less than concentrations of fluoride in the upper hydrogeological unit and were similar to background concentrations observed in the northern-most up-gradient monitoring well. Concentrations of fluoride were below the DEQ and EPA standards in all monitoring wells bordering the western boundary of the site in the vicinity of Aluminum City, Roux noted. [26]

Similar to site-wide soils, multiple metals likely related to background concentrations for Montana were detected in groundwater samples, including 18 different metals in groundwater samples from the upper hydrogeological unit, and 15 different metals in groundwater samples from below the upper hydrogeological unit. The most frequently detected metals included calcium, potassium, sodium and barium in 100% of groundwater samples, magnesium in 92% of groundwater samples, and copper, manganese, and iron in more than 50% of groundwater samples. Concentrations of metals were generally below the DEQ and EPA standards in all groundwater samples, with the exception of arsenic within the upper hydrogeological unit immediately downgradient of the West Landfill and Wet Scrubber Sludge Pond and barium from below the upper hydrogeological unit near the Rod Mill. Although concentrations of detected metals were generally below the DEQ and EPA standards, the concentrations of select metals (including aluminum, arsenic, cobalt, iron and lead) were highest in groundwater immediately downgradient of the West Landfill and Wet Scrubber Sludge Pond – the same areas as the elevated cyanide and fluoride concentrations, Roux noted.[27]

Unlike site-wide soils, calcium, potassium and sodium were detected in 100% of groundwater samples. Given the frequency of detection in groundwater and lack of frequent detections in site-wide soils, these analytes were likely naturally occurring in groundwater, Roux noted. However, several of the deep wells had notably higher calcium concentrations (e.g. a maximum of 922,000 micrograms per liter at one well), as compared to concentrations of calcium within the wells screened near the water table (average concentration of 62,820 micrograms per liter). These elevated calcium concentrations in the deep wells appeared to be attributable to the cement grout used during the well construction, Roux noted. General chemistry analyses including ammonia, chloride, hardness (as calcium carbonate), nitrate + nitrite (as nitrogen), orthophosphate (as phosphorus) and sulfate were performed on groundwater samples to obtain data that could be utilized in chemical fate and transport evaluations and modeling, if needed, in the future as part of the Remedial Investigation and Feasibility Study, Roux noted. [28]

Surface water and sediment

Laboratory analytical data for the surface water samples collected from site for Roux's draft Phase 1 Site Characterization Data Summary Report were evaluated to determine the presence, or lack thereof, of contaminants of potential concern. Cyanide was detected in six sampling locations (27%) of surface water samples, including all three locations within the Backwater Seep Sampling Area, one location in the Flathead River, one location in the South Percolation Ponds and one location within Cedar Creek. Concentrations of total cyanide exceeded the DEQ and EPA standards of 200 micrograms per liter in two of three surface water samples from the Backwater Seep Sampling Area. Cyanide was not detected in any surface water samples collected within the Cedar Creek Reservoir Drainage Overflow Ditch and the Northern Surface Water Area. Fluoride was detected in 100% of the surface water samples, with none exceeding the DEQ and EPA standards of 4,000 micrograms per liter for fluoride in any surface water sample. Concentrations of fluoride exceeded the EPA's tap water risk screening level of 80 micrograms per liter in nine sample locations, including samples collected within the Backwater Seep Sampling Area, the South Percolation Ponds, the Northern

Surface Water Area and one location within the Cedar Creek Reservoir Drainage Overflow Ditch. [29]

Metals that were observed in site-wide soil samples and groundwater samples were sporadically detected in surface water site-wide, with none exceeding the DEQ and EPA standards, Roux noted. Volatile and semi-volatile organic compounds, PCBs and pesticides were analyzed on the three samples collected in the South Percolation Ponds as additional analyses in accordance with the Remedial Investigation and Feasibility Study Work Plan, Roux noted. One volatile organic compound, methylene chloride, was detected in one sample below all screening levels. All samples had no detections of semi-volatile organic compounds, PCBs or pesticides. No surface water samples were collected in the North Percolation Ponds because no water was present during the sampling events. Cyanide was detected in surface waters at concentrations exceeding the DEQ standard of 140 micrograms per liter and the EPA standard of 200 micrograms per liter at two locations in the Backwater Seep Sampling Area near the Flathead River. Cyanide was detected in one surface water sample with a concentration of 209 micrograms per liter and another with a concentration of 213 micrograms per liter. Outside of the Backwater Seep Sampling Area, the highest concentration of cyanide observed in surface water was at the South Percolation Ponds along the Flathead River, with a concentration of 12.5 micrograms per liter. Cyanide was also detected in one surface water sample from Cedar Creek, with an estimated concentration of 2.3 micrograms per liter, and a sample from the Flathead River, with an estimated concentration of 3.2 micrograms per liter. Cyanide was not detected in any of the upstream surface water samples, including Cedar Creek, the Cedar Creek Reservoir Drainage Overflow Ditch and the Flathead River. [30]

The maximum fluoride concentrations in surface water were observed in sampling locations within the Backwater Seep Sampling Area, at concentrations of 2,560 and 2,570 micrograms per liter respectively, which were less than the DEQ and EPA standards of 4,000 micrograms per liter. Outside of the Backwater Seep Sampling Area, the highest concentration of fluoride observed in surface water was at the South Percolation Ponds along the Flathead River, with a concentration of 379 micrograms per liter. Fluoride was detected in all of the upstream samples, including Cedar Creek at a concentration of 38.3 micrograms per liter, the Cedar Creek Reservoir Drainage Overflow Ditch at a concentration of 39.2 micrograms per liter, and the Flathead River at a concentration of 56.2 micrograms per liter. Similar to site-wide groundwater, the most frequently detected metals include calcium, potassium, sodium and magnesium in 100% of the samples, aluminum in 95% of the samples, and manganese in 68% of the samples. Concentrations of metals were below the DEQ and EPA standards, Roux noted. [31]

Sediment analytical data also were evaluated to determine the presence of contaminants of potential concern. Cyanide was detected in 11 out of 12 sediment samples, Roux noted. Cyanide concentrations did not exceed the EPA's industrial regional screening level of 15 micrograms per kilogram in any sediment samples. Cyanide concentrations exceeded the EPA's residential regional screening level of 2.3 micrograms per kilogram in two sediment samples – one within the Northeast Percolation Pond and one in the Backwater Seep Sampling Area near the Flathead River. Fluoride was detected in 100% of sediment samples but did not exceed the residential or industrial regional screening level in any of the sediment samples. Semi-volatile organic compounds (primarily polycyclic aromatic hydrocarbons) were detected at concentrations exceeding industrial regional screening levels in sediment samples collected within both of the North Percolation Ponds. Polycyclic aromatic hydrocarbons also were detected at concentrations exceeding residential regional screening levels, with most frequent exceedances occurring in the Backwater Seep Sampling Area and the South Percolation Ponds. Metals were detected at concentrations exceeding residential regional screening levels at 11 sediment sample locations. Aluminum concentrations exceeded the industrial regional screening level of 110,000 micrograms per kilogram in one sediment sample from the Northeast Percolation Pond. Arsenic concentrations exceeded the industrial regional screening level in six sediment samples. PCBs and pesticides were not detected in any of the sediment samples collected for the Phase I Site Characterization report. [32]

Cyanide was detected within all sediment samples with the exception of the Flathead River, Roux noted. Although cyanide was detected in most sediment samples, cyanide concentrations were below the residential regional screening level of 2.3 micrograms per kilogram in all samples, with the exception of one sample collected from within the Northeast Percolation Pond at 7.8 micrograms per kilogram and one sample collected within the Backwater Seep Sampling Area at 3.2 micrograms per kilogram. Fluoride was detected within 100% of sediment samples. Although fluoride was detected in all sediment samples, fluoride concentrations did not exceed the residential or industrial regional screening level. The highest detection of fluoride was measured in a sediment sample from the Northeast Percolation Pond at 219 micrograms per kilogram. One or more polycyclic aromatic hydrocarbons were detected in more than half of the sediment samples, with the most frequent detections in the North Percolation Ponds, the Backwater Seep Sampling Area, and the South Percolation Ponds. Polycyclic aromatic hydrocarbons most frequently detected in sediment samples included benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Polycyclic aromatic hydrocarbons concentrations were less than residential regional screening levels within the three sediment samples collected within Cedar Creek, with the exception of benzo(a)pyrene, which exceeded the residential regional screening level of 0.016 micrograms per kilogram at two sampling locations. Concentrations of at least one or more polycyclic aromatic hydrocarbons exceeded residential regional screening levels in the three samples collected within the South Percolation Ponds and one sample in the Backwater Seep Sampling Area. [33]

The two sediment samples that were collected within the North Percolation Ponds had concentrations of multiple polycyclic aromatic hydrocarbons that exceeded the industrial regional screening levels, with the highest magnitude of exceedances typically within the Northeast Percolation Pond. Fourteen different metals were detected in every sediment sample collected during the Phase I Site Characterization. With the exception of arsenic, which was detected at concentrations exceeding industrial regional screening levels in eight sediment samples, the only other metal that was detected at concentrations above the industrial regional screening levels was aluminum (from a sediment sample within the Northeast Percolation Pond). With the exception of arsenic, metals including aluminum, cobalt and iron were detected at concentrations exceeding EPA residential regional screening levels in ten or more of the sediment samples collected site-wide. Thallium was detected at concentrations exceeding the residential regional screening level of 0.078 micrograms per kilogram in both samples collected from the North Percolation Ponds, but was not detected in any of the other sediment samples. [34]

Landfills and soil sampling

According to Roux's draft report, soil gas screening was conducted at four locations in the Wet Scrubber Sludge Pond, two locations within the Center Landfill and near ten landfill vents set up for the West Landfill. Only one low-level detection of methane was found at a vent for the West Landfill, Roux reported. Volatile organic compounds were detected at nine out of 30 locations, but only one was above 1 ppm. Passive soil gas sampling was conducted at eight locations within the Former Drum Storage Area and two locations within the Operational Area at a former storage area. One or more volatile organic compounds were found in all 10 passive samplers, with benzene and tetrachloroethene being the most commonly detected volatile organic compound. Based on these results, additional investigation was recommended for the Former Drum Storage Area and the Operational Area, Roux noted. [35]

An electrical resistivity/induced polarization geophysical survey was conducted with six transects of the site. The depth of waste material in the East Landfill was estimated to be about 40 feet, the depth of waste material in the Wet Scrubber Sludge Pond was about 15 to 43 feet deep, the depth of waste in the Center Landfill could be about 50 feet, and the depth of waste in the West Landfill could be 106 feet, Roux reported. Ten linear transects of the landfills were conducted using ground-penetrating radar. Results indicated an engineered landfill cap existed at the East Landfill and the West Landfill but not at the Wet Scrubber Sludge Pond, the Sanitary Landfill and the Center Landfill. Soil sample results were compared to the EPA's residential and industrial regional screening levels and the EPA's groundwater risk-based soil screening levels. Cyanide was detected in greater than 78% of all soil samples. The detected concentrations exceeded the industrial regional screening level of 15 micrograms per kilogram in less than one percent of all soil samples and exceeded the residential regional screening level of 2.3 micrograms per kilogram in less than 3% of all soil samples. Fluoride was detected in greater than 99% of all soil samples. Fluoride concentrations did not exceed the industrial regional screening level of 4,700 micrograms per kilogram in any soil samples. The detected concentrations exceeded the residential regional screening level of 310 micrograms per kilogram in less than 1% of all soil samples. Semi-volatile organic compounds (primarily polycyclic aromatic hydrocarbons) were detected frequently across the site, Roux noted. [36]

Polycyclic aromatic hydrocarbons were most frequently detected in surface soil samples, with one or more polycyclic aromatic hydrocarbons detected in greater than 90% of the surface samples. The frequency of detection decreased with depth such that polycyclic aromatic hydrocarbons were detected in less than 52% of the intermediate depth samples, Roux noted. Polycyclic aromatic hydrocarbons were detected at concentrations that exceeded both the residential regional screening levels and industrial regional screening levels at multiple locations across the site and at all three depth intervals. Metals were detected frequently across the site. Sixteen different metals were detected at frequencies between 90% and 100% of the samples collected, which was indicative of metals as naturally occurring substances in the environment, Roux noted. Exceedances of residential regional screening levels were observed for several metals. However, exceedances of industrial regional screening levels for metals were limited to less than 2% of all samples, with the exception of arsenic which exceeded the industrial regional screening level of 3 micrograms per kilogram in approximately 84% of all samples collected. Roux noted that arsenic commonly exceeded the industrial regional screening level in soils throughout Montana and discussed the matter further in the report. [37]

Volatile organic compounds were detected in surface soil samples from across the site, typically at trace, low part per billion concentrations, with 23 different volatile organic compound analytes detected across all sampling depth intervals. The most common volatile organic compounds detected were acetone, benzene, toluene and xylenes, with the frequency of detection of these four compounds at the various depth intervals ranging from approximately 62% to 95%. Despite the frequency of volatile organic compounds detection, none exceeded residential or industrial regional screening levels, including at the areas within the Former Drum Storage Area and Operational Area where volatile organic compounds were detected in passive soil gas samples. PCBs and pesticides were not detected in any of the discrete soil samples collected during the Phase I Site Characterization investigations. Several polycyclic aromatic hydrocarbons and metals and some volatile organic compounds were observed in all soil sampling intervals at concentrations that frequently exceeded the EPA's groundwater risk-based soil screening levels. Roux noted that the EPA's groundwater risk-based soil screening levels were "so low, due to the inherently conservative methodology used to develop the criteria, such that for many analytes any detection results in an exceedance." [38]

For soil sampling site-wide, cyanide was detected within 93% of surface soil samples, 87% of shallow soil samples, 56% of intermediate depth soil samples, and 66% of the below water table soil samples. Although cyanide was detected widespread across the site, cyanide concentrations were below the EPA's industrial regional screening level of 15 micrograms per kilogram in all samples, with the exception of four samples collected from within the Northeast Percolation Pond (one surface, two shallow and one intermediate). Cyanide concentrations were below the residential regional screening level of 2.3 micrograms per kilogram in all samples, with the exception of eight samples collected within the Northeast and Northwest Percolation Ponds and two samples beneath the former Cathode Soaking Pit near the Main Plant Area. Fluoride was detected within 100% of surface and shallow samples, 98% of intermediate samples, and 100% of the below water table samples. Although fluoride was detected widespread across the site, no fluoride concentrations were above the industrial regional screening level of 4,700 micrograms per kilogram. Only four samples exceeded the residential regional screening level of 310 micrograms per kilogram for fluoride, all of which were collected within the first 2 feet-below-land-surface from within the Rod Mill, eastern Main Plant Area and Paste Plant. [39]

Polycyclic aromatic compounds that were most frequently detected above industrial regional screening levels included benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene, Roux noted. The frequency and magnitude of exceedances decreased with increasing depth; however, exceedances of all three screening levels were observed within the deepest samples (10-12 feet-below-land-surface) around the Main Plant area. Samples around the Main Plant area and North Percolation Ponds typically exceeded the industrial regional screening levels, with the highest magnitude of exceedances within the surface sampling interval. Polycyclic aromatic compounds were typically not detected or detected at concentrations less than residential regional screening levels along the western boundary and northwest portion of the site. [40]

Thirteen different metals were detected in all site-wide soil samples collected during the Phase I Site Characterization. The areal distribution of detected metals in soil samples was widespread across the site, and in general the concentrations appeared similar across the three sampling intervals. Arsenic was detected at concentrations exceeding the industrial regional screening level of 3 micrograms per kilogram in approximately 84% of all samples collected. The only other metals that were detected at concentrations above industrial regional screening levels included thallium (five samples located within the Northeast Percolation Pond and the Influent Ditch), aluminum (only one sample) and copper (only one sample). Aluminum, arsenic, cobalt, iron and manganese were detected at concentrations exceeding residential regional screening levels in more than 70% of all samples. Lead did not exceed the residential regional screening level of 400 micrograms per kilogram in any of the samples in any of the depth intervals, including within samples that were sieved to assess the fine fraction of lead. [41]

Soil sampling was also conducted in the Operational Area, an area where operations took place but no known contaminant source existed. Cyanide was detected in 100% of the incremental soil samples from this area. Cyanide was detected at concentrations above the industrial regional screening level of 15 micrograms per kilogram in 5% of surface samples, but did not exceed the industrial regional screening level in any shallow samples within the Operational Area. Cyanide was detected at concentrations above the residential regional screening level of 2.3 micrograms per kilogram in 7% of surface samples and 7% of shallow samples. Fluoride was detected in 100% of the incremental soil samples. Fluoride did not exceed industrial regional screening level of 4,700 micrograms per kilogram in any sample collected within the Operational Area. Fluoride was detected at concentrations above the residential regional screening level of 310 micrograms per kilogram in 33% of surface samples and 26% of shallow samples. Semi-volatile organic compounds (primarily polycyclic aromatic hydrocarbons) were detected frequently across the Operational Area. Twelve polycyclic aromatic hydrocarbon analytes were detected in greater than 90% of the samples, with concentrations exceeding residential regional screening levels for eight different polycyclic aromatic hydrocarbon analytes, and industrial regional screening levels for six different polycyclic aromatic hydrocarbon analytes. [42]

Metals were detected frequently across the site. Seventeen different metal analytes were detected at frequencies between 90% and 100% of the samples collected, which was indicative of metals as naturally occurring substances in the environment. Exceedances of residential regional screening levels were observed for several metals, primarily similar to site-wide soil (aluminum, arsenic, cobalt, iron, manganese, and thallium). Arsenic was detected at concentrations exceeding the industrial regional screening level of 3 micrograms per kilogram in 100% of samples collected from the Operational Area, similar to site-wide soils. PCBs were detected in approximately 7% of the samples collected within the Operational Area. PCBs were detected at concentrations exceeding the residential regional screening level in two of the incremental soil samples. PCBs did not exceed industrial regional screening levels in any of the samples collected within the Operational Area. Pesticides were not detected in any incremental soil sample collected within the Operational Area. Similar to the site-wide soils, the analytical soil data from the Operational Area indicated that concentrations of polycyclic aromatic hydrocarbons and metals were observed that often exceeded the EPA's groundwater risk-based soil screening levels for one or more analyte. Therefore, Roux noted, the results from the soil sampling would also be evaluated in tandem with the groundwater sampling analytical data collected from the monitoring wells within the Operational Area to assess whether, and to what extent, constituents detected in soil are impacting groundwater quality. [43]

Cyanide and fluoride were detected in 100% of the incremental soil samples collected in the Operational Area. Cyanide was detected at concentrations above the industrial regional screening level of 15 micrograms per kilogram in two incremental soil samples, both in surface samples collected in the Former Drum Storage Area. Cyanide concentrations were above the residential regional screening level of 2.3 micrograms per kilogram from four additional incremental soil samples, including in three surface soil samples from within the Former Drum Storage Area and a shallow soil. Fluoride was detected at concentrations above the residential regional screening level of 310 micrograms per kilogram in 25 incremental soil samples collected from 14 decision units within the Operational Area. Fluoride concentrations exceeded the residential regional screening level in 33% of surface samples and 26% of shallow samples. Although fluoride was detected frequently above the residential regional screening level, no concentrations exceeded the industrial regional screening level of 4,700 micrograms per kilogram in any sample collected from the Operational Area. [44]

Polycyclic aromatic hydrocarbons frequently detected at concentrations above industrial regional screening levels within the Operational Area included benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Similar to site-wide soils, polycyclic aromatic hydrocarbon exceedances were distributed throughout the Operational Area and were similar in magnitude to polycyclic aromatic hydrocarbon exceedances observed in discrete soil samples collected around the Main Plant area. Similar to site-wide soils, the frequency and magnitude of exceedances decreased with increasing depth from surface samples to shallow samples across the Operational Area; however, four polycyclic aromatic hydrocarbons were detected at concentrations greater than industrial regional screening levels in more than 20% of shallow incremental soil samples from within the Operational Area. [45]

Seventeen different metals were detected in all incremental soil samples collected within the Operational Area. Similar to site-wide soils, aluminum, arsenic, cobalt, iron and manganese were detected at concentrations exceeding residential regional screening levels in all incremental soil samples. Arsenic was detected at concentrations exceeding the industrial regional screening level of 3 micrograms per kilogram in 100% of incremental soil samples. Arsenic was detected with concentrations greater than 10 times the industrial regional screening level in one incremental soil sample. No other metals were detected at concentrations above industrial regional screening levels. The areal distribution of metals exceedances was widespread across the Operational Area, and in general concentrations appeared similar within the two sampling depth intervals, Roux noted. Lead was detected in 100% of the incremental soil samples collected within the Operational Area, and was detected at concentrations exceeding the residential regional screening level of 400 micrograms per kilogram in one incremental soil sample. [46]

Soil samples from drainage structures were also analyzed. Cyanide was detected at concentrations above the residential regional screening level of 2.3 micrograms per kilogram in one drainage structure. Cyanide was not detected at concentrations above the industrial regional screening level of 15 micrograms per kilogram within or below the sampled drainage structures. Fluoride was detected at concentrations above the residential regional screening level of 310 micrograms per kilogram in three of the four soil samples from within the drainage structures and two of the three samples from immediately below the drainage structure. Fluoride was not detected above the industrial regional screening level of 4,700 micrograms per kilogram within or below the sampled drainage structures. Semi-volatile organic compounds (primarily polycyclic aromatic hydrocarbons) were detected at concentrations above industrial regional screening levels in samples from within and immediately below the drainage structures, with a decreasing magnitude of exceedance of polycyclic aromatic hydrocarbons within samples from below the drainage structures. Metals were detected at concentrations above residential regional screening levels, most frequently including aluminum, arsenic, manganese, iron and cobalt. Arsenic was detected at concentrations above the industrial regional screening level of 3 micrograms per kilogram in seven drainage structure samples. Volatile organic compounds were not detected at concentrations above residential or industrial regional screening levels in any of the soil samples collected from within or below the drainage structures. PCBs and pesticides were not detected in any of the soil samples collected within or below the drainage structures. [47]

The Background Area soil sampling site was located in an open field west of the plant. Cyanide was detected in greater than 83%, and fluoride within 100%, of all Background Area soil samples. The measured concentrations for both cyanide and fluoride did not exceed residential or industrial regional screening levels in any samples collected within the Background Area. Semi-volatile organic compounds (primarily polycyclic aromatic hydrocarbons) were detected across the Background Area, primarily in surface soil samples (several polycyclic aromatic hydrocarbons were detected in six out of the eight background surface samples). The frequency of polycyclic aromatic hydrocarbon detections decreased with depth such that no polycyclic aromatic hydrocarbons were detected in the intermediate depth. No polycyclic aromatic hydrocarbons were detected at concentrations above industrial regional screening levels in any sampling depth interval. Benzo(a)pyrene and benzo(b)fluoranthene were detected at concentrations above the residential regional screening levels (0.016 micrograms per kilogram and 0.16 micrograms per kilogram, respectively) in surface soils. Metals were detected in all soil samples collected from the Background Area. Aluminum, arsenic, cobalt, iron and manganese were detected at concentrations above residential regional screening levels. Arsenic was detected at concentrations exceeding the industrial regional screening level of 3 micrograms per kilogram in 83% of the samples. Volatile organic compounds were detected across the Background Area. Acetone, benzene and toluene were mostly commonly detected, with concentrations less than residential and industrial regional screening levels in all soil samples collected from the Background Area. PCBs and pesticides were not detected in any soil sample collected from the Background Area. [48]

Cyanide was detected within 88% of surface samples, 88% of shallow samples and 75% of intermediate depth samples in the Background Area. Although cyanide was detected widespread across the Background Area, cyanide concentrations were below the residential regional screening level of 2.3 micrograms per kilogram in all samples. Fluoride was detected within 100% of surface, shallow and intermediate depth samples collected from the Background Area. Although fluoride was detected widespread across the Background Area, fluoride concentrations were below the residential regional screening level of 310 micrograms per kilogram in all samples. Polycyclic aromatic hydrocarbons that were most frequently detected in the Background Area included benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluoranthene, phenanthrene and pyrene (greater than 33%). The frequency and magnitude of exceedances decreased with increasing depth, with the majority of detections in the surface soil. There were no detections of polycyclic aromatic hydrocarbons in the intermediate depth (10-12 ft below-land-surface) soil samples in the Background Area. With the exception of benzo(a)pyrene and benzo(b)fluoranthene, polycyclic aromatic hydrocarbon concentrations were typically less than residential regional screening levels within all sampling intervals in the Background Area. Polycyclic aromatic hydrocarbons were detected at concentrations less than industrial regional screening levels within all sampling intervals in the Background Area. [49]

Sixteen different metals were detected in 100% of the surface, shallow, and intermediate depth soil samples collected from the Background Area. The areal distribution of the detected metals was widespread across the Background Area, and in general the concentrations appeared similar across the three sampling intervals. Aluminum, arsenic cobalt, iron and manganese were detected at concentrations exceeding residential regional screening levels in at least 79% of the samples collected in the Background Area. Arsenic was detected at concentrations exceeding the industrial regional screening level of 3 micrograms per kilogram within 88% of surface samples, 88% of shallow samples and 75% of intermediate depth samples. Exceedances of residential and industrial regional screening levels for metals were similar to site-wide soils, Roux noted. [50]

Potential migration pathways

According to Roux's draft Phase 1 Site Characterization Data Summary Report, potential media for the transport of contaminants of potential concern could include groundwater, surface water and sediments, and soil vapor. Cyanide and fluoride were the primary contaminants of potential concern found in groundwater at the site, based on the evaluation of the data collected for the report and historical data. This finding was consistent with the preliminary conceptual site model presented in the Remedial Investigation and Feasibility Study Work Plan, Roux noted. The West Landfill, the Wet Scrubber Sludge Pond and potentially the Former Drum Storage Area located immediately west of those features appeared to be the primary sources of the cyanide and fluoride in groundwater. The elevated concentrations of cyanide and fluoride appeared to be present within groundwater that originated in the West Landfill and Wet Scrubber Sludge Pond area and generally migrated southward in the upper hydrogeological unit toward the Flathead River. These concentrations of cyanide were consistent with similarly observed concentrations of cyanide in surface water from the Backwater Seep Sampling Area near the Flathead River, a location where groundwater emerged from the upper hydrogeological unit and entered the Flathead River. The data from monitoring wells supported that the migration of cyanide and fluoride followed the southerly groundwater flow patterns in the upper hydrogeological unit and was not moving toward Aluminum City. [51]

The monitoring wells located along the southwest boundary closest to Aluminum City were non-detect for cyanide, Roux noted. CFAC had been conducting quarterly sampling of residential wells in Aluminum City since June 2015. All of the data from this sampling effort continued to indicate that impacted groundwater had not migrated beneath the residential areas near the plant boundary and was not migrating in that direction. The data also indicated that groundwater quality was similar, or concentrations decreased, in wells that were downgradient of the Main Plant and the North Percolation Ponds. The contour maps indicated no increase in concentrations along the flow path that would be clearly indicative of potential contributions from secondary source areas downgradient of the landfill. Concentrations were generally non-detect in monitoring wells screened below the upper hydrogeological unit. These findings were consistent with observed hydrogeological conditions, which indicated that there was only limited, if any, hydraulic connectivity between the upper hydrogeological unit and the water-bearing zones screened in the underlying glacial till. [52]

Many of the metals that were detected in soil samples were either non-detect or present at very low concentrations in groundwater. However, groundwater sampling results for metals such as aluminum, arsenic, cobalt, iron and lead indicated detections or greater magnitude of concentrations within the same monitoring wells where the highest measured concentrations of cyanide and fluoride were observed (from wells immediately downgradient of the West Landfill and Wet Scrubber Sludge Pond). The occurrence of metals in groundwater at these locations indicated that these metals likely came from the same source as the cyanide and fluoride. However, the elevated concentrations of metals in groundwater were generally limited to the three or four wells located immediately downgradient of the landfills and typically did not extend in the southern direction like the dissolved cyanide or fluoride, Roux noted. [53]

Polycyclical aromatic hydrocarbons were detected frequently in site-wide soils. Where polycyclical aromatic hydrocarbons were detected in soil, the concentrations exceeded the EPA's protection of groundwater risk-based soil screening levels, suggesting a potential for impact to groundwater. However, polycyclical aromatic hydrocarbons were non-detect in all groundwater samples. Roux noted that this finding could be explained by the inherent lack of dissolved-phase mobility that was common for polycyclical aromatic hydrocarbons due to their low solubility and high carbonoctanol partition coefficients. Polycyclical aromatic hydrocarbons typically were tightly bound to soils, Roux noted. In addition, the complete absence of polycyclical aromatic hydrocarbons in groundwater, despite the widespread exceedances of the groundwater regional screening levels, was reflective of the conservative nature of the regional screening levels, Roux noted. These findings indicated that the polycyclical aromatic hydrocarbons observed in soil were not impacting groundwater quality. [54]

The findings indicated that both Cedar Creek and the Cedar Creek Reservoir Overflow Ditch were losing streams and thus were not groundwater discharge locations. The fact that the Cedar Creek Reservoir Overflow Ditch lost water as it flowed directly adjacent to the West Landfill and Wet Scrubber Sludge Pond warranted further examination to determine if water losses from the overflow ditch could be contributing to the observed contaminant migration in groundwater. Prior site investigations had identified that the Backwater Seep Sampling Area, described as a backwater area of the Flathead River, was a location where groundwater was expressed, Roux noted. Historical sampling in the Backwater Seep Sampling Area had found the surface water to contain cyanide and fluoride at concentrations exceeding the DEQ and EPA standards. The preliminary conceptual site model and historical data for the Backwater Seep Sampling Area were confirmed based upon the results of the Phase I Site Characterization, Roux noted. [55]

The surface water samples collected in the South Percolation Ponds for the draft report contained cyanide and fluoride at maximum concentrations of 12.5 micrograms per liter and 379 micrograms per liter, respectively. Cyanide and fluoride had historically been found at similar concentrations in the Montana-permitted discharge located at the west end of the South Percolation Ponds, indicating that the discharge from the outfall could be a source of the cyanide and fluoride in the ponds. However, cyanide had not been detected in the discharge to the ponds since October 2015, Roux noted. This suggested that cyanide observed in the ponds might be attributable to groundwater seepage into the ponds, which was possible based upon groundwater flow, comparison of groundwater and surface water elevations, and the documented extent of cyanide and fluoride in groundwater, Roux noted. The water level in the South Percolation Ponds had been observed to correlate closely with surface water elevations in the Flathead River, indicating a hydraulic connection between the two water bodies and corresponding potential for impacted surface water within the South Ponds to migrate to the river, Roux noted. [56]

Sediment was not observed at most sampling locations within the Flathead River because of the fast-flowing nature of the river, which precluded the deposition and accumulation of any fined-grained deposits within the river. The only exceptions to this were in the Backwater Seep Sampling Area, which was a quiescent backwater water area where fines could settle and accumulate, and a small distributary located south of the South Percolation Ponds. As stated in the preliminary conceptual site model, the flat topography that existed within one-half mile of Cedar Creek suggested there was little potential for overland transport of site-related contaminants into Cedar Creek. However, Roux noted, cyanide was detected in Cedar Creek surface water in 2013 at concentrations exceeding DEQ and EPA standards. The surface water sample collected three years later from this location during the September 2016 sampling event contained cyanide at a similar concentration. As this condition was inconsistent with the initial conceptual site model, an additional sample was collected from a location slightly upstream in December 2016 in an effort to identify the source, Roux noted. [57]

Reactions to the Roux report

Roux's lengthy Feb. 27, 2017 draft site characterization report, which was placed online in late March, identified three contaminants of potential concern for the Superfund cleanup of the CFAC site – cyanide, fluoride and polycyclic aromatic hydrocarbons. The likely main source for the cyanide was spent potliner dumped in the West Landfill from 1955 to 1985. The West Landfill was unlined and could be 106 feet deep – meaning the bottom of the dump was at times lower than the groundwater table of the upper hydrogeological unit. While fluoride as a gas or particulates had been emitted by the smelter during all the years of its operation – possibly up to 10,000 pounds per day by 1969, which settled on the surrounding area – the likely source for fluoride in the groundwater beneath the plant site was the Wet Scrubber Sludge Pond. Discharge from the wet scrubber system for treating primary emissions at the smelter from 1955 through 1980 was calcium fluoride, which was dumped in the unlined pond. According to Roux's report, the Wet Scrubber Sludge Pond could be 15 to 43 feet deep and may have lacked an engineered cap.

The likely sources for polycyclic aromatic hydrocarbons were materials handling locations for petroleum coke and coal tar pitch used in the Paste Plant as well as secondary emissions from the open-topped Soderberg anodes, which escaped through the clamshell vents along the top of the potroom buildings. Polycyclic aromatic hydrocarbons were found in surface soil all around the plant site, but because the compounds didn't readily dissolve in water, they remained bound in the soil near the surface. Roux's report also described the underlying hydrogeology and the overall direction of groundwater movement beneath the Superfund site – groundwater moved in a southerly direction toward the Flathead River, but not toward the Aluminum City neighborhood next to the plant or toward the city of Columbia Falls. In addition, Roux reported that the upper hydrogeological unit, which was contaminated with cyanide and fluoride, didn't mix with the lower hydrogeological unit.

The release of Roux's report was well covered in local media – despite the 7,315 pages contained in a single file on the Internet. "With the information I have seen, there were no new surprises," EPA Project Manager Mike Cirian told the Flathead Beacon. "We are in the process of reviewing the report… Upon completion of our review, we will use this information to help guide changes necessary on the next phase of sampling." The EPA planned to meet with the Columbia Falls City Council on April 17 and hold a public meeting on April 19 to discuss the report. "The preliminary indicators are that there are no red flags and no surprises," CFAC Environmental Project Manager John Stroiazzo told the newspaper. "The source is where we thought it was, and this data now confirms it. We know where that water plume is going, and the program continues with additional monitoring." Cyanide was found to be widespread across the CFAC site, detected within 93% of surface samples, 87% of shallow samples, 56% of intermediate samples and 66% of samples from below the water table. The report noted that the cyanide concentrations were below the EPA's industrial regional screening level with the exception of four samples collected from the Northeast Percolation Pond. In addition, cyanide concentrations were below the EPA's residential regional screening level in all samples with the exception of eight samples collected from within the Northeast and Northwest Percolation Ponds and from beneath the former Cathode-Soaking Pit. Fluoride was found in 100% of surface and shallow samples, 98% of intermediate samples and 100% of samples from below the water table. None of the samples exceeded the EPA's industrial regional screening level, the newspaper reported. [58]

Several people commented on the Beacon's story online. "And this is why we have regulations," Cynthia Petek said. "Regulations that are being dismantled by the current idiotic administration. Making money is a fine thing, but if you cannot drink the water, eat food grown from the earth, or breathe the air, because it has been poisoned and polluted, the trade off is not worth it. When our children have terminal illnesses that be linked to a polluted environment, money is not worth it." In his comment, Tom Tuttle questioned Stroiazzo's statement that there were "no red flags" in the new report. "What? 'No red flags here,'" Tuttle said. "We have cyanide going into the Flathead River! Does that not warrant a red flag?" David Skinner, a conservative columnist for the Beacon, responded to Tuttle's comment. "Did you read the article?" Skinner asked. "Let me help: 'Cyanide concentrations were below the EPA's regional screening level of 2.3 mg/kg in all samples with the exception of eight samples collected within the Northeast and Northwest Percolation Pond and two samples beneath the former Cathode Soaking Pit location within the main plant area.' So it was detected. At levels below screening." [59]

Tuttle responded to Skinner's online comment. "Dave… yeah, let's talk," Tuttle said. "You have an abundance of not only cyanide but fluoride and arsenic and a multitude of other toxic chemicals that have been leaching into Cedar Creek from the NW Perc Pond and landfill for a very long time that eventually ends up in the Flathead River. How many CFalls kids have fished, waded and played in Cedar Creek over the last 40 years? Were you one of them by chance? These chemicals won't cause death at these amounts but more insidious illnesses such as neurologic disorders that manifest as tiredness, learning disabilities and asthma in children. They can also kill, weaken and inhibit reproduction of fish and their food sources at very low amounts which is not taken into consideration when deciding chemical screening levels. You may not give a flip about CFalls kids but I do know you like to fish... so yes, this is even a problem (red flag?) even for you." Sheryl Hester responded to Tuttle's and Skinner's comments. "Yes, friends. We grew up downstream from this in a valley over an underground lake just a few miles away that our wells tapped into," Hester said. "Of course it's located next to the beautiful Flathead River that flows into Flathead Lake, a river that we've kayaked down many times right by this. A lake I spent my childhood in. There were mostly Republicans who ran it and worked there. One of the owners took a great deal of money from the employees and then was revered, befriended and admired in our community, still is today. Kinda has a theme to it." [60]

The Beacon also interviewed a resident in Aluminum City about the Superfund investigation. Donna Tolar said she moved into a home at the end of 13th Street in Aluminum City in 2003. Her property abutted the CFAC plant's boundary, and her residential drinking well was the closest to the plant. She told the Beacon that she didn't know much about contaminants at the plant site until her boyfriend at the time, who was working at the CFAC site, warned her about drinking the water from her well. A few years later the EPA showed up, she said. "I've had 10 grandchildren go through this house," she said. "I worry about it." Like others in Columbia Falls, Tolar faced a lengthy Superfund investigation to determine the severity and extent of hazardous materials in and around the 960-acre site. The first round of sampling results confirmed what many had suspected – that landfills containing hazardous materials were contaminating groundwater beneath the plant site. An underground plume of contaminated groundwater had been identified and was moving toward the river, according to the Roux report, but initial sampling results did not detect any contaminants near the Aluminum City neighborhood. "This is going really slow, but I understand," she said. "They have their steps. And we let the state try it first and the state was not successful. Thank God (the EPA) didn't take us off the (National Priorities List) or else we would have to start all over again. I'm happy (the EPA) kept us. I want to know what's out there. I want it cleaned up." [61]

Montana Public Radio reported on the Roux report on March 20. "There wasn't anything out there that we didn't expect, and there's no urgent or emergency type responses needed at this time," Mike Cirian told the radio station. He said the report was extensive, with data coming from 44 monitoring wells. "Some of the preliminary good news is that the contaminant is not getting to Aluminum City," he said. [62] KPAX-TV spoke to several local residents about Roux's report. One neighbor with young children said she wasn't concerned about drinking the water from her well. "We've been here for six years and we've been drinking the water and we haven't had any trouble," Rebecca Reynolds said. The television station also cited a statement about the Roux report by EPA media officer Lisa McClain-Vanderpool. "We are in the process of reviewing the report," she said. "A copy is currently being made for the repository in the Columbia Falls Library, and CFAC is making it available electronically. Upon completion of our review, we will use this information to help guide any changes necessary on the next phase of sampling." [63]

KCFW-TV also covered Roux's report. "We successfully accomplished the goal of Phase 1, which is critical to the project," John Stroiazzo told the television station. "The work performed provides an understanding of site conditions and will help determine the road map forward." [64] The report found that groundwater contamination was not moving toward Aluminum City, but those living near the plant still had concerns. "As they start exposing things, we'll learn more," Chris Hader told the television station. "What all is buried there? Who knows? We'll learn. It's going to be a time-consuming process though, I guarantee that." Frank Sizemore said he wanted to see the site cleaned up and put to use. "The only thing I hope is they can get her cleaned up and get some employment out there of some kind," he said. Cirian told the television station he didn't think a quick turnaround was likely to happen. "This is Phase 1 of our data summary report, and it uses the results from our first round of sampling," he said. "We continue to run our quarterly sampling while we develop the Phase 2 approach. Upon completion of our review, we will use this information to help guide any changes necessary on the next phase of the remedial investigation. Once we complete the remedial investigation, we will use that information to produce a feasibility study. This is planned to be completed by 2021." Only after all that was completed could the cleanup process begin, he said. [65]

Community involvement

On March 16, 2017, the EPA Region 8 office in Denver issued a 36-page brochure describing its proposed Community Involvement Plan for the CFAC Superfund cleanup project. According to the EPA's timeline, the remedial investigation and feasibility study followed by a proposed plan was expected to take place from 2016 to 2021. After that would come the record of decision and the remedial design decision followed by cleanup, with remedial action involving the construction or implementation of the cleanup, construction completion, post-construction completion and removal from the National Priorities List. Although the public was concerned about health risks from the site, the EPA said there were no claims of health-related issues or illnesses linked to the site or its past operations. The EPA noted that the public wanted the site cleanup to be thorough, protective, lasting and timely. The agency noted that some people had expressed frustration about the number of years it took to initiate investigation and sampling, while others were concerned about potential impacts to the local economy by placing the site on the Superfund's National Priorities List. Impacts to water quality and the broader watershed also were a public concern, and some people wanted a say in how the site would be used in the future, the agency reported. Some people had expressed interest in establishing a Community Advisory Group through the EPA, and some expressed concern about a Community Advisory Group existing at the same time as Glencore's CFAC Community Liaison Panel, which could lead to confusing or contradictory information. [66]

The Columbia Falls Aluminum Company Community Liaison Panel met at the Columbia Falls High School cafeteria on April 19, 2017. Ann Green Communications facilitated the meeting. Representatives from the EPA, DEQ, Flathead County, City of Columbia Falls, Sens. Jon Tester and Steve Daines, and other interested parties were present, along with community residents who were members of the panel or guests. A Roux representative provided a summary of the company's recent report. The next round of sample results, which were collected in December, had been submitted to the EPA and results would be announced in summer 2017, the panel was told. Another round of samples would be collected in June during spring runoff. The EPA planned to release a risk assessment work plan by the end of 2017, which would outline any environmental and human health dangers resulting from contamination at the industrial site. [67] The highest concentrations of cyanide were found just north of the plant downgradient from the West Landfill, which was not unexpected based on historical data and anecdotal evidence provided by former plant employees, Roux hydrogeologist Mike Ritorto told the panel. "It's information that jives historically with the site," he said. Cyanide concentrations in an underground plume trending south toward the Flathead River decreased the further they were from the landfill sources. Cyanide concentrations were slightly below or above the safe drinking water threshold by the time the plume reached the river. Cyanide levels were low enough to meet DEQ discharge permits, Cirian told the panel, but more tests results would be needed. [68]

"All of this info has to be taken into account to help us find out what's there," Cirian told the panel members, but some members expressed frustration at the lengthy process. "We're going to be waiting four to five years to address it, to fix it," Flathead County Commissioner Phil Mitchell said. "If you know this is going on now, with two sets of samples, why would we wait so long?" Cirian responded by referring to the legal process. "We're not allowed to prejudge the remedy," he said. "We need to have all that information." Don Bennett, president of Freedom Bank, had an optimistic outlook. "To me, it looks better than I thought it might've ended up looking like," he said. "I'm taking it kind of as good news." Stroiazzo later told the Flathead Beacon about ARCO's responsibility for cleaning up the site. "At the end of the day, Glencore is not responsible for this," he said. "Yes, we've started the process. Yes, we've gone forward with the remedial investigation. But ARCO will most likely be brought to the table." EPA officials confirmed to the Flathead Beacon that they had contacted ARCO, seeking their participation in the remedial investigation, but ARCO had declined. Stroiazzo said

Glencore was willing to initiate the site investigation and pay for the initial costs because it was in the best interest of the community and would move the project forward, while the EPA could identify potentially responsible parties for the cleanup. "We've been taking a lot of heat and getting a lot of bad press about this," Stroiazzo said. "But we try to be as honest as we can. We're funding everything. We've got oversight from EPA and we're paying for everything. At this point in time, I don't think anybody can say anything bad about us. The place operated for a long, long time and provided a lot of economic stability. It's unfortunate that it's come to this." [69]

On May 24, 2017, the Hungry Horse News published a letter by former CFAC engineer Nino Berube that was sharply critical of the Community Liaison Panel's April 19 meeting. Berube had worked for 25 years at the aluminum plant, serving as a production supervisor, general foreman and engineering superintendent before voluntarily leaving in 2003. [70] Berube also was president of Gadow Mutual Pump, an organization representing families that shared a residential well in Aluminum City. [71] "There's a real problem with Columbia Falls Aluminum Co.," he wrote. "CFAC-Glencore have used the 'Columbia Falls Liaison Panel' to present only the company's side of the story. The Hungry Horse News did a good job covering the last community meeting in April, and published the presented data accurately. Unfortunately, it's only CFAC propaganda. CFAC had a canned presentation to convince the general population that the problems at the CFAC site are small, known, and in a very specific location far away from anything else. CFAC and EPA know that the published picture does not fully depict the pollution levels and direction of plume movement." [72]

Berube noted that results from the first of four sets of data on groundwater contamination were presented at the meeting, with the other three sets of data to be determined in the future. But two other sets of data were not presented, he said – one jointly compiled by the DEQ and EPA in 1993 and another compiled by an EPA contractor in 2013. The 1993 set included data taken from five drinking and cooling water wells on the CFAC site, Berube said, and the 1993 data set indicated that an additional underground plume of contaminated groundwater existed east of the potlines building, which extended all the way to the Flathead River. "These five wells have the longest history of active use and by far the highest concentration of sampling, since they supplied the plant's drinking water," Berube said. "CFAC-Roux pulled these wells from the group to be sampled in their preparation of the Remedial Investigation-Feasibility Study document, and the EPA technical team never even noticed these critical wells were removed." Berube noted that data from the five production wells was included in the 2013 study, which was used by the EPA to determine that the CFAC site should be placed on the Superfund's National Priorities List. [73]

Furthermore, Berube said, the 2013 data indicated that another underground plume of contaminated groundwater was moving southwest toward Aluminum City. “The real question that remains today is where and how many plumes exist?” Berube asked. “A better effort is needed to quantify the data before telling the community the good news: ‘It’s not flowing toward town but into the Flathead River!’” Berube described how fine clay particles about 100 feet below the surface separated the upper and lower hydrogeological layers and protected the deeper aquifer from contamination. But he noted that the top of the upper hydrogeological layer was higher than the bottom of the unlined landfill that was believed to be the source of contamination. Berube also suggested that high velocity streams entering the CFAC site from the east, after running down Teakettle Mountain, forced the water table to rise toward the surface. He cited similar hydrogeological features in the Flathead Valley at Lake Blaine, Many Lakes and Echo Lake. [74]

Berube said CFAC capped the leaking West Landfill in 1994 following field work, drilling additional monitoring wells and negotiating with the state. According to Berube, CFAC told the state that, based on computer modeling by an environmental contractor, contamination levels in monitoring wells near the West Landfill would fall to background levels once the landfill was capped. “CFAC used this testimony to obtain a discharge permit to continue dumping fluoride and cyanide into the Flathead River,” Berube said. “It’s now 23 years later, and the pollution levels in the wells CFAC identified in 1994 have barely changed. Neither CFAC nor MDEQ ever followed up on the results of the cap and the decision that gave CFAC the discharge permit.” He called on studying all onsite landfills within the upper 100-foot layer and removing their wastes to a safer environment. Berube also expressed concern about the former drum storage area, citing a sample from the area with 7,320 micrograms per liter of cyanide when the drinking water standard was 200 micrograms per liter. He suggested a link between the former drum storage area and a high cyanide reading in a sample from Cedar Creek – with no gate attendant present at the dump sites, spent potliner may have been dumped at the former drum storage area, he wrote. “The CFAC dumps exist as unlined, unmanifested repositories of materials from 1953 to today,” he said. “No official record exists of what has been buried on this site.” [75]

Berube also noted that very little was said at the April 19 Community Liaison Panel meeting about polycyclical aromatic hydrocarbons. He said the plant consumed from 140,000 to 250,000 pounds of coal tar pitch each day, a material that contained numerous dangerous compounds. He noted that each day about 66,000 gallons of contaminated waste water from the wet scrubber that treated exhaust gases at the paste plant for 45 years was “directly injected into the underground aquifer below the plant.” He noted that large volumes of polycyclical aromatic hydrocarbons drafted out of the potrooms' rooftop clamshell vents. He also noted that a PM-10 particulate pollution study of the Flathead Valley, conducted by the EPA with participation by the city of Columbia Falls and the aluminum plant, "clearly defined the location and size of the airshed that the company's pollution impacted." [76]

Berube claimed business interests were interfering with the ongoing cleanup study. "There are no written goals for the site at this time because this suits the interests of CFAC and the EPA," he said. "It hurts the people of Columbia Falls and Flathead County, as we will be left with whatever these entities decide. We as a community need to provide written goals; otherwise it's nearly impossible to accomplish anything and we will have no say for the future. EPA and CFAC can enact a plan if we give them a written path." Berube was also critical of the role and position of the Community Liaison Panel. "Another goal would be to disband the community liaison panel," he said. "We have a good core of 30 or so folks who have attended nearly every meeting, but we are rubber-stamping CFAC's easiest and cheapest path forward as they only give us their side of the story." He called for community involvement in two areas – setting goals for government agencies related to the final disposition of the property, and getting technical people from the EPA and CFAC to do a better job of assessing and defining the site before making final decisions. [77]

Glencore-Xstrata project engineer John Stroiazzo responded to Berube's letter on June 2, 2017. Stroiazzo's cover letter was printed in the Hungry Horse News. "All of us involved in the CFAC remediation effort have been working together to assure the best possible result is obtained for the people in our area with always the goal of being protective of human health and the environment," he wrote. "We have hired the best environmental engineers and remediation specialists in the field. All their work – from the investigation of contamination at the site to development of an appropriate remediation plan – has been under the direct supervision of the U.S. EPA and Montana Department of Environmental Quality." Stroiazzo also commented on Berube's public role in the matter. "As a member of the Community Liaison Panel established to assure the public has an active role in the remediation process, Mr. Berube should be aware of the work being done to identify all the contamination at the site and develop the appropriate strategies to address each and every one of these," he wrote. Stroiazzo disagreed with many of Berube's points. "We believe he is misguided in his assessment and using outdated data and assumptions to make erroneous conclusions," Stroiazzo wrote. [78]

Stroiazzo specifically addressed nine of Berube's points. He noted that the data sets on groundwater contamination from the 1993 and 2013 reports came from less than 20 monitoring wells, while the most recent data set came from 60 wells sampled by Roux.

Stroiazzo noted that CFAC and Roux recently installed 44 new monitoring wells. Furthermore, he said, the data sets from 1993 and 2013 had been included in the Remedial Investigation and Feasibility Study Work Plan that was approved by the EPA and DEQ in 2015. Stroiazzo disagreed with Berube's claim that data from the five drinking and cooling water wells had been withheld from the latest report. He noted that historical data did not show that the highest concentrations of cyanide or fluoride were found in the five wells, and Roux had proposed to omit the five wells from the latest study because, once electrical power had been shut off at the plant site, it was difficult to sample the wells. The EPA had approved that proposal, he said. [79]

Berube's claim that data from the 2013 report indicated that a plume of contaminated groundwater was moving toward Aluminum City also was false, Stroiazzo said. Based on more detailed sampling in 2016 and 2017 and quarterly monitoring of residential wells in Aluminum City, Roux believed groundwater flow beneath the aluminum plant site was toward the Flathead River, not Aluminum City. Stroiazzo also addressed Berube's claim that the top of the upper hydrogeological layer was sometimes higher than the bottom of the leaking landfill. He noted that Berube's interpretation came from geophysical methods used in the draft site characterization report, which were inconclusive. Further investigation of the landfill was needed, Stroiazzo said. He also noted that Berube's claim that CFAC did not follow up on groundwater quality results after capping the West Landfill was false. CFAC monitored the groundwater quality around the landfill on a semi-annual basis. "Overall, the trends in fluoride and cyanide concentrations are decreasing," he said. Stroiazzo also noted that the draft site characterization study had determined that groundwater beneath the former drum storage area flowed in a southerly direction, so any groundwater contaminated by the former drum storage area would not have migrated west to Cedar Creek. Additional investigations of the former drum storage area would take place during the Phase 2 characterization study, he said. [80]

Stroiazzo also noted that Berube's claim that little was said in the draft site characterization report or at the April 19 Community Liaison Panel meeting about polycyclical aromatic hydrocarbons was false. Polycyclical aromatic hydrocarbons were identified in the draft site characterization study as a primary contaminant of potential concern, he said. Regarding Berube's claim that waste water from the paste plant's wet scrubber was directly injected into the underground aquifer, Stroiazzo noted that the use of percolation ponds for the discharge of the waste water had been well documented for many years, and the activity was conducted pursuant to a discharge permit from the DEQ. Regarding Berube's claim that there were no written goals for the CFAC cleanup site because that suited the interests of CFAC and the EPA, Stroiazzo noted that the CFAC site had been placed on the Superfund's National Priorities List and was being addressed with the ultimate goal of protecting public health and the environment. “The specific remedial goals and objectives for any future remedy will be determined by following this process, which is the same process that is conducted at all federal Superfund sites across the country,” Stroiazzo said. [81]

On Oct. 5, 2017, local residents, government and company officials and former CFAC employees exchanged information about the cleanup project during a public meeting at the Teakettle Room in Columbia Falls. Ritorto said tests from monitoring wells at the site indicated high concentrations of fluoride and cyanide in groundwater near the landfills, with concentrations decreasing as groundwater flowed away from the landfills toward the Flathead River. “The contaminants of concern are fluoride and cyanide,” he said, and test wells near homes at Aluminum City continued to be clean. [82] The highest concentrations of fluoride and cyanide had been observed in groundwater around the west landfill and the center landfill, Ritorto said. Concentrations in groundwater near the Flathead River were well below the EPA-mandated levels, he said. Surface water sampling had identified two “low level detections” in Cedar Creek on the west side of the plant site during the first two rounds of sampling, and those would continue to be evaluated, he said. [83]

Berube asked the Roux representatives at the public meeting why other contaminants had not showed up in samples from the test wells, such as hydrocarbons and mercury. He said mercury from switch gear in the rectifier building had been dumped on site when the equipment went bad, used fuel tanks were buried at the site, thousands of gallons of contaminated cooling water was injected into groundwater, and waste oil was sprayed on the dirt roads to keep dust down. Other former plant workers agreed with Berube and expressed interest in providing their knowledge to the cleanup officials. “I’m amazed that they continue to ignore the wealth of knowledge of former employees,” Shepard commented. Ritorto responded by noting that volatile organic compounds that could be found in waste oil and coal tar pitch were found in soils at the CFAC site, but not in groundwater. Cirian said he welcomed input from former employees, but noted that “just poking holes in the landfills hoping to find something isn’t the right way to do it.” A hole in a landfill cap could make problems worse, he said. [84] Cirian also noted that the Flathead River had changed course, recently eroding about 50 feet of riverbank along the CFAC property and exposing rip-rap used in the past to fortify the bank. The river was pushing toward the south percolation ponds, and the EPA planned to take steps to reinforce the bank to prevent the river from entering the ponds. “We’re trying to fast-track some things to take some action,” he said. “We don’t want any contamination that might be there shooting down the river.” The EPA and CFAC planned to hold another public meeting in May 2018. [85]

Stroiazzo told the group in the community hall that Calbag Resources was approaching its final year in demolition of the above-ground structures at the CFAC smelter site. "We're getting very close to the end," he said. Calbag crews were removing K088 hazardous materials from the 451 reduction pots remaining at the site when the smelter closed down – about 26,000 tons of material that contained cyanide and other hazardous materials. The last of the pots was expected to be removed by November, he said. [86] One of the potrooms had already been demolished, and the entire plant should be leveled within a year or so, he said. [87] Stroiazzo added that CFAC had been approached by several parties interested in using the site once it was cleaned up. "People are coming to CFAC with what could be done," he said. "We take those questions very seriously and engage those respective folks." However, he added, "So far nobody has offered to set up shop and do business. But we keep the door open." [88] The EPA would draft a human health risk assessment for the CFAC site within the next six months, EPA toxicologist Susan Griffin told the group. The assessment would not take into account past risks to workers at the plant. The panel, which included city and county leaders, company representatives, the EPA, state and federal representatives, and members of the public, expected to meet again in May 2018. [89] On Oct. 27, 2017, local media reported that CFAC had sent the EPA a check for $302,326 as payment for the agency's role in overseeing the Superfund cleanup at the CFAC site. According to the company's press release, CFAC had spent another $3.4 million on remedial investigation, including installing 40 monitoring wells and paying environmental consultant Roux Associates. [90]

On Jan. 31, 2018, the Hungry Horse News reported on past work at the CFAC Superfund site and future plans. Cirian told the newspaper eight more monitoring wells would be drilled across the 900-acre site, and wells located at the southeast end of the site would be tested in 2018. Two of the new wells would be drilled near the Aluminum City residential area. In 2017, crews obtained 520 soil samples, 12 sediment samples, 87 surface water samples and 242 groundwater samples. Cirian said sampling in 2018 would take place during high water, likely in June, and during low water, likely in the fall. Investigative work would be done at several water-production wells in the southeast corner of the site, including pulling the pumps. Former CFAC workers had criticized the EPA for not having those water-production wells tested. Cirian also reported that crews had shored up a coffer dam along the Flathead River that protected CFAC's settling ponds along the river. About 30 feet of river bank washed out in spring 2017, so the EPA decided to bolster the coffer dam with rip-rap. Roux Associates also had recently released two important reports on the Superfund site – the Screening Level Ecological

Risk Assessment Report and the Final Phase 1 Site Characterization Data Summary Report, the newspaper reported. [91]

Roux released its Sept. 18, 2017 Screening Level Ecological Risk Assessment Report on the CFAC Superfund site in mid-January 2018. The 351-page report could be downloaded from a CFAC website maintained by Ann Green Communications. The report by Michael Ritorto and Andrew Baris evaluated the potential risks to ecological receptors from materials released or disposed of at the former smelter site. The purpose of the assessment, in accordance with EPA guidance for Superfund sites, was to provide risk managers with sufficient information to determine what remedial actions were necessary to protect the environment from chemicals of potential ecological concern (COPECs) or other hazards at the site. The report relied on information gathered for Roux Associates' Phase 1 Site Characterization Report, including soil, sediment, groundwater and surface water sampling. The study site included 1,340 acres of Glencore's 3,196-acre property, including the footprint of historic industrial operations roughly bounded by the Cedar Creek Reservoir Overflow Ditch to the north, Teakettle Mountain to the east, the Flathead River to the south and Cedar Creek to the west. The site included seven closed landfills, one active landfill, material loading and unloading sites, two closed leachate ponds, and several percolation ponds. [92]

Water level data collected in summer 2016 for the Phase 1 Site Characterization Report when the Flathead River was at low flow indicated that the river was receiving groundwater from the upper hydrogeological unit beneath the CFAC site, the risk report stated. Based on the topography, Cedar Creek was within half a mile of the CFAC site but was at a higher elevation than the groundwater elevations at the site, indicating the creek was a perched or losing stream rather than a gaining stream. The overflow ditch also was higher than groundwater elevations at the site, indicating the ditch also could be a losing stream. The South Percolation Ponds were three ponds connected in series and adjacent to the Flathead River, measuring 2.4, 1.2 and 6.6 acres in size. Historically, the ponds received water from numerous sources, including the plant's sewage treatment plant, contact water from the casting plant's direct-chill equipment, non-contact cooling water, process wastewater from casting-mold cleaning, non-process wastewater from the fabrication's shop steam cleaning, and stormwater drainage. At the time of the sampling by Roux, only stormwater discharged into the South Percolation Ponds. [93]

The North Percolation Ponds included two interconnected wastewater ponds. The two-acre Northeast Percolation Pond was built in 1955 and continued to be a discharge point for stormwater drainage. The Northeast Percolation Pond had received water from the Paste Plant's briquette production system; non-contact cooling water; non-process wastewater from the mason shop, battery shop and garage; wastewater from the garage's steam cleaning and anode pin steam-cleaning; boiler blowdown from the laboratory building; air conditioner condensate; Paste Plant wet scrubber blowdown until 1999; the cathode soaking pits prior to 1978; and process area stormwater drainage. The eight-acre Northwest Percolation Pond had received water from the Northeast Percolation Pond through a 1,440-foot long unlined ditch. Based on aerial photography, Roux suggested the Northwest Percolation Pond may have been constructed in 1972. The Northern Surface Water Feature was a seasonal ponding area discovered during the May 2016 habitat assessment. Located just south of the West Landfill, the feature was seasonally fed in the spring and early summer by at least two groundwater seeps north and west of the feature. [94]

In developing a conceptual site model for the risk report on the Superfund site, Roux addressed ecological fate, transport pathways and media of concern; exposure pathways; key receptors; and assessment endpoints and measurement endpoints. Reconnaissance indicated that the site contained several functional terrestrial and aquatic habitats. Roux Associates noted that according to the EPA, the "most significant exposure route for wildlife is ingestion of chemicals in impacted media." Wildlife could ingest chemicals by drinking surface water or by incidentally ingesting contaminated soil or sediment while grooming or foraging. These ingested chemicals could bioaccumulate in the tissues of plants and animals. The EPA had developed a list of persistent bioaccumulative and toxic chemicals, which included polycyclic aromatic hydrocarbons (PAH), which were commonly emitted at the CFAC plant by the manufacture of anode briquettes and the burning of Soderberg anodes. The primary aquatic pathway of potential concern was the potential presence of COPECs either adhered to the sediment or dissolved in the surface water of the Flathead River. One area where groundwater from beneath the plant site seeped into the river already had been defined by CFAC's Montana Pollutant Discharge Elimination System permit, so another area where groundwater seeped into the river was labeled by investigators as the Backwater Seep Sampling Area. [95]

According to Roux Associates, dissolved COPECs in groundwater will tend to remain in the dissolved phase where there are coarse-grained sediments with little organic material, but groundwater-borne COPECs could adhere to sediment in fine-grained or organic-rich sediments. Whether the COPECs remained dissolved or adhered to sediments also depended upon chemical characteristics of the hazardous materials. According to Roux Associates, cyanide and metal-cyanide anions, as well as dissolved metals, "may adsorb onto oxide minerals or clays with high anion exchange capacities." Roux noted that "the primary mechanism by which chemicals may migrate from sediments at this site would be through physical disturbance, including periods of high river discharge." Another potential migration pathway to the sediments and surface water of the Flathead River would be through stormwater runoff, specifically by the Cedar Creek Reservoir Overflow Ditch, the report said. [96]

Roux concluded in the risk report that, "Based on these findings, it is not anticipated that COPECs present in groundwater discharging to the Flathead River from the site would have a significant impact to the sediment due to the absence of fine-grained material, with the exception of the groundwater discharging in the Backwater Seep Sampling Area." Roux also noted that whereas Cedar Creek was at a higher elevation than the groundwater at the CFAC site, and while there was no evidence of COPEC migration in Cedar Creek, "there is the potential for stormwater runoff from the industrial landfill area towards Cedar Creek." Roux noted that the conclusions found in the Screening Level Ecological Risk Assessment report were "insufficient to dismiss potential ecological risk, and further data gathering or data analyses is recommended to better understand the risk." The company proposed to conduct a COPEC refinement investigation. [97]

Roux Associates also released its Sept. 18, 2017 Phase 1 Site Characterization Data Summary Report for the CFAC Superfund site in mid-January 2018. This was the final version of the Feb. 27, 2017 report, and the 7,415-page report also could be downloaded from a CFAC website maintained by Ann Green Communications. According to Roux, the conceptual site model presented in the EPA's remedial investigation and feasibility study work plan had identified the landfills at the site as a potential source for cyanide and fluoride and potentially other chemicals of potential concern (COPCs). The area of elevated cyanide and fluoride concentrations in groundwater within the upper hydrogeological unit appeared to originate immediately to the west of the Wet Scrubber Sludge Pond, where concentrations of cyanide and fluoride each exceeded 5,000 micrograms per liter. This area of maximum concentration was located immediately downgradient of the West Landfill and the Wet Scrubber Sludge Pond. [98]

Roux noted that this finding was consistent with historical use of these features as disposal locations for cyanide in spent potliner dumped in the West Landfill and fluoride contained in the calcium fluoride sludge dumped in the Wet Scrubber Sludge Pond. In addition, Roux noted, both landfills were unlined and the West Landfill was not covered with a clay cap until 1995. Roux also noted that groundwater elevations in the upper hydrogeological unit adjacent to the West Landfill could fluctuate by more than 50 feet seasonally, indicating the potential for groundwater to rise above the base of the West Landfill. Groundwater sampling elsewhere led Roux to conclude that the Sanitary, Center and East landfills were not contributing sources for cyanide or fluoride to groundwater. Soil sampling around the West Landfill and Wet Scrubber Sludge Pond contained concentrations of cyanide, fluoride and polycyclic aromatic hydrocarbons (PAHs). The concentrations were similar to concentrations found in soil sampled around the Paste Plant, Main Plant and railroad sidings and could be explained as resulting from historical waste-handling practices near the landfills and by aerial deposition of COPCs from historical plant emissions, Roux said. [99]

The Former Drum Storage Area became a feature of concern to the investigators after samples from a well drilled in the center of the storage area were found to contain the highest concentration of cyanide at the plant site – a September 2016 sampling contained 7,320 micrograms per liter. The storage area could be a contributing source to elevated cyanide and fluoride concentrations in the landfill area, Roux said. The North Percolation Ponds were also a feature of concern to the investigators. Soil and sediment samples from the Northeast Percolation Pond and its influent ditch contained among the highest concentrations of cyanide and PAHs, followed by the effluent ditch, the connected Northwest Percolation Pond and the West Pond. Roux noted, however, that COPC concentrations decreased with increased depth in the soil sampled around the North Percolation Ponds. Both the Northeast Percolation Pond and the West Percolation Pond were hydraulically downgradient of the West Landfill and the Wet Scrubber Sludge Pond. Soil samples taken around the CFAC site contained concentrations of cyanide and fluoride that typically exceeded the EPA's protection of groundwater risk-based soil screening levels but below the EPA's industrial regional-screening levels at all locations and below the EPA's residential regional-screening levels at all locations but two. Soil samples from across the plant site also contained PAH concentrations that exceeded the EPA's industrial regional-screening levels. [100]

In its discussion of cyanide, Roux noted that prior studies of spent potliner leachate had documented that cyanide at aluminum smelter sites existed primarily in the form of iron-cyanide complexes. "Typically, ferrocyanide and ferricyanide are more stable in the environment (tend not to release free cyanide and are less bioavailable)," Roux said. "Thus, any potential for effects due to cyanide exposure is likely to be overestimated, as free cyanide would only comprise a fraction, if any, of the total cyanide present." Roux, however, said it would continue to look for free cyanide in future sampling. In its discussion of volatile organic compounds, including benzene, toluene, ethyl benzene and xylene, together grouped as BTEX, Roux noted that the widespread occurrence of acetone in soil samplings may have resulted from laboratory contamination. The widespread distribution of volatile organic compounds in general across the CFAC plant site was similar to that of PAHs and was likely the result of the use of petroleum coke and coal tar pitch at the smelter, Roux suggested. [101]

Multiple metals were detected in site-wide soil sampling at concentrations that exceeded the EPA's residential regional-screening levels, including aluminum, iron, cobalt, manganese and thallium, Roux said. Based on background sampling and statistical data analysis, those metal concentrations were likely background concentrations, Roux suggested. However, certain metals were found at higher concentrations than background levels within the North Percolation Ponds and the ditch connecting the two ponds. Soil sampling also was conducted in the plant's switchyards because of past transformer fires in the historical record. The low occurrence of chemicals that could be generated by the combustion of polychlorinated biphenyls (PCBs commonly found in electrical equipment) during a transformer fire, however, suggested that dioxins and fibenzofurans no longer needed to be retained as a COPC in future study of the Superfund site. [102]

Groundwater sampling indicated a southerly flow pattern in the upper hydrogeological unit, but also that the impacted groundwater had not migrated beneath Aluminum City and other neighboring residential areas and was not migrating in that direction. Well sampling also indicated only limited, if any, hydraulic connectivity between the upper hydrogeological unit and the water-bearing zones in the underlying glacial till, Roux reported. While the presence of some metals in the groundwater was attributed to the same source as cyanide and fluoride – that is, the landfills – sampling indicated that metals in groundwater had not migrated as far as cyanide and fluoride. Groundwater sampling also indicated that PAHs, while common in surface soil samples, had not impacted groundwater. Roux also noted that the Cedar Creek Reservoir Overflow Ditch lost water to the area directly adjacent to the West Landfill and Wet Scrubber Sludge Pond, and this water could get into the upper hydrogeological unit and contribute to groundwater flow at the plant site. [103]

Surface water samples from the South Percolation Ponds adjacent to the Flathead River contained maximum concentrations of cyanide at 12.5 micrograms per liter and of fluoride at 379 micrograms per liter, but cyanide had not been detected in the discharge from the ponds since October 2015. Sediment was not observed at most sampling locations along the river because of the fast-flowing nature of the river. Roux also noted that the water level in the South Percolation Ponds correlated closely with surface water elevations in the Flathead River, indicating a hydraulic connection between the two water bodies. Roux concluded that preliminary findings indicated that elevated levels of cyanide and fluoride in groundwater, the Backwater Seep Sampling Area and the South Percolation Ponds "are not significantly impacting surface water quality within the main stem of the Flathead River." Further sampling and evaluation would be conducted, Roux said. [104]

In the meantime, concerns had been raised by a doctor in Whitefish about a spike in cancer cases in Flathead County that could be linked to emissions by the CFAC smelter or by Plum Creek Timber Co.'s medium-density fiberboard plant. The MDF plant had emitted large amounts of formaldehyde until the company installed a $9.5-million biofilter in 2008. According to statistics provided in February 2018 by Heather Zimmerman, an epidemiologist at the Montana Department of Public Health and Human Services, Cancer Control Programs, Flathead County had a statistically and significantly higher incidence rate of cancer per 100,000 people than Montana from 2011 to 2015 in four age-adjusted categories – all sites (533.8 to 451), prostate (158.9 to 112.2), lung (64.9 to 55.9) and melanoma (36.3 to 25.9). [105]

"Flathead County does have a higher cancer incidence rate than what we see in Montana overall," Zimmerman said. "When I look at the incidence rate for the 10 most common types of cancer in Montana, we can see that this increased cancer rate is probably because of an increase in prostate cancer, lung cancer, and melanoma." Zimmer said the tumor registry could not explain why these cancers were occurring more often in Flathead County residents, and her agency didn't collect any information about potential risk factors or environmental exposures in the registry data. "However, when we look at the rate of deaths due to cancer, we can see that the rate of death is the same in Flathead County as in Montana overall for all cancers and for the 10 most common types of cancer," Zimmerman said. "This tells us that the increased incidence is likely not due to more severe cases of cancer occurring in Flathead County. The increased incidence may be because of more screening (especially for prostate cancer) or more aggressive diagnosis that finds early cancers or slow-growing cancers that would not ultimately progress to more severe disease and death." [106]

Zimmerman said the Montana Environmental Health Assessment and Education program, which is part of her agency, was working on an assessment of public health risks from the CFAC site. "They have reviewed all of the environmental data that has been collected thus far on the site," she said. "Next they will estimate the amounts of contaminants workers and trespassers might have taken in from touching surface soil and sediments and accidentally swallowing them from hand-to-mouth contact." The Environmental Health Assessment and Education program staff also would estimate residents' past exposure levels from drinking tap water with cyanide levels found in off-site private wells in 2013. "They call these completed exposure pathways - the means by which people might take in site-related contamination," Zimmerman said. "Only then can they determine what adverse health effects might be expected from these estimated exposure levels, by comparing them with levels known to cause illness from animal and medical studies." Contaminant levels measured in surface water and most groundwater samples would only pose a risk if people used this water as a drinking water source, she noted. Because of the known emissions of polycyclic aromatic hydrocarbons by the CFAC smelter, the Environmental Health Assessment and Education program staff "will recommend testing of off-site yard surface soil for PAHs, as currently no such testing has been done," Zimmerman said. "They will also recommend continued testing of nearby off-site drinking water wells." [107]

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