CFAC RI-FS Comments before EPA Agrees to the Proposal
Robert,

I was able to talk with 2 of the four former CFAC employees that I felt would add the most significant amounts of information and oversight to the current process of defining what are the issues to be looked into at the CFAC site.

There was a hesitancy to jump right in that was best described by the old adage " no good deed goes unpunished" the other two folks were unavailable because of a death in the family and the other is a snow bird. One item I did hear repeated several times was the fact that EPA has made minimal effort to actively find ex-CFAC employees who could help with their task of identifying decisions and places where high probability activity occurred. Along with this sentiment was one that seems to coincide with the above concern. It was a question in folks' minds about why EPA is taking such a docile role in dealing with CFAC. They wondered why all the newspaper quotes made it sound like EPA was so happy with CFAC and Glencore because they were cooperative as opposed to doing their job of protecting people and the environment from pollutants they have already identified at the site.

I do think after talking to these individuals that if EPA wanted input from a narrow slice of the community that would be interested in helping you attain a true technical understanding of the plant; and you reached out with this as a community input you would sanction, you will get a quality group of people that will define the plant for you in a manner that reflects what truly happened in this aluminum reduction facility over most of its 54 year operating life.

If you want community input that will help you access the dangers this plant may pose this is a group you need to build. It is not the political, business, government or environmental community but it is the correct place to start if you desire a strong and accurate technical foundation for the plant operation before you start making regulatory type decisions.

Robert the rest of this document is directed more toward Mike and is my mini attempt to explain how this plant operated and why it is important to know before attempting to regulate the remedial action agenda. This lack of basic understanding, in my opinion, is a prime reason in why the State of Montana was never able to properly discharge their obligation to minimize the levels of air, water and soil pollution. It is a prime component of why the EPA is involved with another national priorities listed site in the State of Montana. I will provide the information and an open request that you and Mike provide an avenue for a small group of ex-employees to become more active in helping you understand what CFAC was all about and where study areas will provide the best chance of providing decision making data to help you and CFAC define a remedial plan if one is even necessary.

So far all of the information that I have seen published by EPA and its contractors as well as CFAC and Roux in the RI-FS documents has been very general in nature and in many instances has misleading or incorrect descriptions of site features and technical aspects of the operation. I'm making the assumption here that you have not asked for more details and/or the company's two employees and Roux are not capable of providing most of this type of information. Your technical review you completed several months ago of CFAC- AOC-RI-FS submittal appears to only stress technical concerns that were related to how and where wells and sample points were selected and spacings and grids. I believe there is an equally important area that is technical in the understanding of plant operations that concerns itself with the chemistry of the operations, its outputs, the engineered facilities and SOP's used for control and the disposition of all wastes generated to run and support the operational process.

I will try and briefly explain what some of this entails first and then I will due a small critique of the Phase 1 Site Characterization Sampling and Analysis Plan Addendum.

Before I start this more detailed portion I would first like to revisit the meeting and site walk thru I requested on October 9 of 2015. I did this with you, Roux, and the 2 current CFAC employees to help you all build an initial basis for building the RI-FS phase 1 document. In my opinion it was unsuccessful because the draft of this document that was out for public review at that time was minimally changed to investigate known problem areas. In addition I never

signed off on the final write-up of that plant tour because it contained several items that I never said and this was from a totally recorded tour. The real killer was the disclaimer at the bottom of each page from the CFAC attorney that all this information was priviledged and confidential CFAC information. I was not willing to become CFAC's stooge. I prefer to help both of you get this done as correctly and quickly as possible.

That being said there was some important information shared with you; I presented a list of key decisions CFAC's handful of owners and managers made over its 64 years of existence that need to be screened for investigation and potential remedial changes.

These key plant decisions were:

1 Divert Flathead River's original course in the 1950's and place operational water supply wells and sewer/cooling water percolation ponds on the island.

2 Allow Fluoride and cyanide to flow unabated to the Flathead River for 35 to 64 years

3 Allow Spent Potliner to be stored underground or on land surface where it could be leached

4 Allow fluoride contaminated materials to be stored underground or on surface where it could be leached

5 Allow heavy metals and organic contaminated cooling water to be reinjected into underground water aquifers

6 Unsupervised in-holdings causing environmental degradation

7 Used rectifier transformer and air scrubbing oils, waste motor oils used for dust suppression on roads and dump surfaces

8 No segregation of wastes in dumps- no waste manifest to identify what and where items are buried

9 Non-transparent process to prepare plant for sale in the 1990's

10 Single shell tanks used to store waste oils, hydraulics, fuel, rectifier waste oil and solvents, maintenance fluids and oil burning incinerator feeds in underground tanks

11 Apparent conscious decision by EPA and CFAC to not include ex-CFAC employees from the 60s thru 90's for RI production and review

By understanding why these decisions were made and how the plant carried out these seemingly simple directions you stand the best chance of identifying where things went and what state they currently exist in. That I hope is the focus of the RI.

Understanding the Main Plant Operation:

This should start with the chemistry of the operation and the Main Equipment used to contain the chemical reactions.

Primary Aluminum Production Chemistry is defined by this simplified Chemical Reaction:

$Na_3AlF_6 + Al_2O_3 + 3/2C$ -^H-----^E-----> $3Na^+ + AlF_{-3/6} + 3CO_2 + 2Al$

Cryolite +Alumina +3/2Carbon----------> 3 Sodium ions +6Aluminum Fluoride ions + 3 Carbon Dioxide molecules + 2 Aluminum atoms

The ^H and ^E in the yields arrow stand for inputs of Heat and Electrons

In layman terms Cryolite (a solid salt) that is heated to a 1760 degrees farenheit to liquify the salt will dissolve alumina and with the help of the carbon atoms and the electrons supplied by an electrical current being passed thru the liquid components will produce 3 sodium ions, 6 aluminum fluoride ions, 3 molecules of Carbon Dioxide and 2 atoms of Aluminum metal.

To mechanically control this chemical process an engineered infrastructure was built to contain this chemical reaction, handle and produce the chemicals needed and protect or get rid of the non aluminum products of the chemicals and materials used to contain this chemical reaction.

This engineered infrastructure consist of a transport and materials handling facility to get chemicals for reaction to the CFAC site, a group of facilities to produce the carbon products needed for the chemical reaction(paste plant, laboratory, northeast and northwest percolation ponds) a source of heat and electricity to run the process(transformer yard, rectifier,south percolation ponds) and finally the reactor for the control of the conversion of Alumina to Aluminum metal. This reactor is referred to usually as the operating cells. The cell is composed of 4 essential parts, an anode, cathode, and an electrical grid and finally a pollution control system to handle all of the other chemical outputs besides aluminum that exit each cell. This is the heart of the process and it functions by suspending a solid chunk of carbon in a pool of molten cryolite. The cryolite dissolves the alumina much like sugar in coffee and in this condition the fluoride ions and the electricity supplied electrons break the aluminum to oxygen bonds in the alumina and allow for the production of aluminum metal. This metal sinks to the bottom of the cathode where it is eventually removed as the final product of the plant. The cathode is nothing more than a large carbon lined bathtub that collects this product along with all other metals that were contaminants of the alumina and carbon products used in this process. This is the source of the majority of all of the other metals that have already been identified in all of the north and south percolation ponds.

Commented [AS1]: These are usually referred to as "pots"

Because this process takes place at such high temperature all of the products liberated from the anode, as it burns, and the cryolite, as it dissolves alumina, are eliminated from the cells as gases and solid particulates that historically were scrubbed with water solutions of sodium hydroxide or were passed in later years thru dry scrubbers (main potline building, A-398 scrubbers, fan tower scrubbers, room 8 roof scrubber, calcium hydroxide waste treatment precipitator, north and south percolation ponds, all plant landfills and the wet scrubber sludge pond).

The final piece of the puzzle is the human factor because someone had to control this entire process in every detail. This means there was a permanent human presence 24/7 at this facility for over 60 years now. This number varied from a handful at the end of the plants life to maximum of 1300 people during the late 1970's and early 80's. Most of the 60 year life the

manpower contingent number was in the area between 500 and 900 employees. This crowd required the daily necessities of food, water, sanitation and materials to carry out their assigned duties. Impacts were created for(water wells and support infrastructure,sewers, waste treatment plant, south percolation ponds/lagoons, dumps to dispose of human generated foods and other waste products).

Now it's important to go back to the original chemical reaction and define the size of the problem managed inside the CFAC plant.

Let's start with the three most important chemicals in this process and define volumes first and then the size of the reactors/cells to contain this process.

The three chemicals of greatest importance are alumina, aluminum and carbon.

In simple terms it requires:

2 pounds of alumina to produce 1 pound of aluminum

Commented [AS2]: This is roughly correct

Each pound of Aluminum produced consumes 0.60 pounds of carbon

Commented [AS3]: This is roughly correct

Now by knowing the amperage the plant was running, the ampere efficiency and the number of cells operational the true magnitude of the volumes being handled can be calculated. In our case the amperage being run was in the 95,000 range in the 1950s and moved up to the 100,000 range in the 60's and 70's. In the 1980's and 1990's it steadily climbed from this to 106,000 for most of the 1990's and the early 2000's. The last 4 years of operation it was in the 110,000 range. This is important because each cell produces 1776 pounds of aluminum per day per 1,000 amps at 100% ampere efficiency. The plant ran in the low 80% efficiency in the 50's, 60's and 70's. In the 80's it ran 85 to 88% efficiency and in the 90's it was around 92% before falling back the last 10 years of operation to around 89%.

For example in 1992 we were running 106,000 amps at 92% current efficiency on every cell.

Commented [AS4]: This discussion is not very useful since it is missing voltage which is needed to convert amps to watts which is the accepted way of measuring power. This also assumes the reader is familiar with the conversion of AC to DC in order to operate the cells. Where did the AC come from? Nearby dams?

This calculates to the following daily production from the cells:

106x1776 x 0.92=1,732#Aluminum /cell

The average number of cells running per day was 598.6 so the total daily plant production was

1,732#x 598.6 = 1,036,775#Aluminum/day for the plant-- 518 tons

In that year the plant produced 378,422,870#'s or 189,000 tons

Its relation to other numbers means we used .60 x 189,000tons=113,400 tons of carbon from the paste plant of which 30,600 tons of coal tar pitch and 158,400 tons of petroleum coke were consumed to make this 189,000 tons of carbon.

The original production equation uses cryolite to supply fluoride ions to make the chemical process work. In 1992 the plant used roughly 4,730 tons of this chemical to maintain the volume of cryolite bath in each cell of the plant and of this volume 144.5 tons was required to make up for the fluoride that left the plant and contaminated the air shed and property surrounding the CFAC plant.

Every year of its 54 years the plant roughly obeyed these percentage with lower number of cells in 1955 to 1965 and 2000 to 2009 reducing the totals accordingly. The one caveat to this is fluoride consumption in the years from 1955 to 1977. In this 22 year time frame the fluoride lost to the environment was a factor of 10(1,445tons) greater than the example I calculated above for a number of cells and amperage and amperage efficiency equal to the year 1992.

These numbers for every month from August 1955 to shutdown in 2009 are available to you out at the plant unless CFAC saw fit to intentionally destroy its operating records. These production and consumption reports were a critical piece of operating history and in the first 25 years of operation were hand compiled by the accounting staff. In addition to operating statistic some that I read contained information of special purchases such as chemicals bought for use in the lab or other specialty items. Once you learn how to read them and the significance of the numbers you will develop a better understanding of the plant and its potential ecological impacts. In the basement where these records are stored is another piece of critical paperwork that I will reference later in this document and that is the originals of all of the airplane photos

Commented [AS5]: This rate of carbon consumption sounds correct. Coal tar pitch is also called "hard pitch."

Commented [AS6]: What is missing is the consumption rate of the large carbon bricks used to make the cathodes (pots) which elsewhere can be about 10 tons per pot and each pot lasts about 3 to 4 years – this waste stream is the "spent potliner." There are also ceramic/firebrick materials used to make the potliners – and they range from 3000 to 4000 for each pot. When spent, a portion of the carbon-impacted ceramic brick material may also become spent potliner.

Commented [AS7]: I don't find this discussion very useful. Also, bath (depending on the exact process) is composed of cryolite, aluminum fluoride, fluor spar, and soda ash. Use the following as a rule of thumb for the rate of consumption to make 1 pound of aluminum: it takes 0.01 lbs of cryolite, 0.45 lbs of aluminum fluoride, 0.002 lbs of fluor spar, and 0.002 lbs of soda ash.

Commented [AS8]: There is not enough information presented to back-check these calculations. The big questions I would ask is how did the fluoride go into the environment? Was the release through solid, liquid, and air transport ?

Commented [AS9]: This is very key – you should have the following minimum info: annual production of Al, annual consumption of carbon streams (pitch, coke, brick, etc.), annual consumption of batch components and then annual waste stream production – scrubber water (maybe treated through a wastewater plant?, sludge from the scrubbers and other semi-liquid waste streams). If the production records are lost, this could be bad.

that were taken of this plant site. Anaconda and Arco were very diligent in this area on an annual basis. CFAC owners were less so; but had several high quality photos taken. They were stored with my staff in the engineering office from 1953 to 2002, because of fire sprinkler concerns, when they were moved to the administrative office basement. These photos were critical reference pieces for plant maintenance and capital project work every year so they should still be there as it would be a very intentional and questionable act to discard this type of useable critical history.

Because the chemical process was contained inside each cell a little discussion of the cell size is appropriate as they are the source of much of the cyanide and fluoride pollution as well as the organic chemical pollutants that have stayed under the radar so far.

There are 600 cells in the plant and for the majority of the 54 years the plant was forced to rebuild between 100 and 250 per year. The exceptions being reduced operations years and the last few years of operations when the west plant cathodes were moved to the east plant and restarted to save on rebuild expenses.

Commented [AS10]: This seems about correct; 100 per year is a good year, 250 one year is a very bad year.

Each cell that currently exists in the plant started at roughly the following weights:

Anodes:

71,000 #'s of carbon

65,000 #'s of steel

Total 136,000 #'s or 68 tons

Cathodes:

Cathode paste 26,300 #'s

Cathode blocks 23,000 #'s cathode blocks

Bricks 17,800 #'s

Steel 56,227 #'s of which 4,400#'s is cast iron

Total 124,000 #'s or 62 tons

Commented [AS11]: This seems reasonable

Because the cathode absorbs sodium ,aluminum, iron and other bath chemical into the lining during operation the weight of cut out cells was found to be in excess of 120 tons and digging and metal removal operations became necessary before attempting to lift every cut out with the 2- 50 ton cranes.

The cells were built and destroyed by hand one at a time and this generated the need for a lot of iron and brick work and probably more important carbon construction to build anodes and cathodes. All of this construction started in the paste plant.

Commented [AS12]: Where the cells were destroyed could be a significant source of cyanide.

The anode is the source of sacrificial carbon for the aluminum making process. We used the carbon to capture the oxygen when we broke the alumina bonds. Without the carbon capturing the oxygen to form CO2 (carbon dioxide) the oxygen would have recombined with the aluminum we produced to reform alumina.

The carbon for the anodes was produced by blending 118 degree celsius softening point coal tar pitch with a precise mixture of crushed and screened petroleum coke. Typical mixture was 23 to27% coal tar pitch and 73 to 77% petroleum coke. In 1992 this is how I arrived at the 30,600 tons of coal tar pitch and 158,400 tons of petroleum coke consumed.

Coal Tar Pitch is a by-product of the steel industry as they need to coke coal to provide chemical carbon and energy for their chemical process. The pitch is the off gases of coking the coal that is cooled and captured as pitch liquid. It is composed of over 10,000 individual identifiable chemicals. This material is contaminated with all manner of heavy metal and many inorganic impurities such as sulfur and arsenic. Over the years the attempt has been made to regulate what and how much of these products escape the control processes. They have been called POM (poly organic material) PaH(poly aromatic hydrocarbons) BaP(Benzo-a-pyrene) and probably others. The truth in all of this is that between the organics, inorganics and heavy

metal contaminants coal tar pitch is a dangerous ecological entity. Since the 1980's the entire Paste Plant was a required respirator area with the exception of the control room and the potlines were a respirator required area above the anode casing with the strong wording that these areas have a potential cancer causing problem because of the coal tar pitch chemicals.

Commented [AS13]: The carbon-handling processes are a source of PAH compounds. Watch for nearby buried piles and recycled water/wastewater streams that were involved in these processes.

Petroleum coke is formed when the refinery has extracted all the easy to get hydrocarbons from the crude oil and what is left is a heavy, impurity concentrated sludge that is fed to the coker to remove the volatile organic and produce a contaminated carbon source we know as petroleum coke. As with coal tar pitch, petroleum coke keeps the contaminants in its original source material whether it is crude oil or coal. Over the years CFAC has used many different sources of coal tar pitch and petroleum coke.

The fact that the paste plant used one pass cooling water to scrub the off-gases from the mixers that combined these two feed sources is a source of concern that should be investigated with the same level of concern as the fluoride and cyanide pollution from the plant.

The cooling water from the paste plant is divided between what is used to remove coal tar pitch fumes and mixer fines exiting the 5 paste mixers at roughly 300 degrees farenheit and the water that directly contacts the liquid briquets as they exit each mixer. Per the 1997 CFAC water discharge permit 66,700 gallons of water come from the mixer fume scrubber and another 591,000 are from the briquet cooling application. In addition 1,255,000 gallons per day come from the compressor cooling water utility. This water all flows to the northeast percolation pond and then on to the northwest percolation pond where it is directly reinjected back into the ground water. This is a daily contaminated water source putting organics, inorganics, and heavy metals directly to the underground water supply. This 1.9 million gallons daily of potentially carcinogenic contaminated liquid should be carefully traced to make sure surrounding water supplies are not being affected. I would think the pitch source like Reilly Chemical at Salt Lake City or other supplier like Koppers in Cleveland, Indianapolis, Detroit or Ironton should have regulatory information around their various plants that EPA has access to, and can use, to quantify the risk in this area with the organics. The petroleum coke came from

Commented [AS14]: Here we go – the paste plant and briquette cooling process water would have PAHs – so track down where these wastestreams went.

many locations but a significant portion came from the Unocal facility north of San Francisco, Enid Oklahoma and Ferndale Washington.

The final area of concern is not with the process or chemical reactions; but with the effects people at the facility had on the environment. These effect are most evident with the decisions that surrounded the waste treatment facility and the need and uses for all of the different dumps and percolation ponds and dry wells.

The waste treatment facility has only primary and secondary treatment capability and the grandfather clause was used by almost every owner to justify continued daily use of an inadequate sewage treatment facility. The unit had tweaks of technology that allowed it to handle the volume of sanitary waste as the plants daily population grew. The problems started when curtailments and line shutdowns drastically reduced the number of people and more importantly the volume of material. This volume loss caused the bacteria to die off and required the drastic step of having many of the valley's septic companies to come to the plant and directly dump their loads into this facility. There were times when the unit didn't adequately treat the waste and this material ended up in the southwest percolation pond. The location of these south percolation ponds in the middle of a low island in the Flathead River is a ridiculous environmental risk that is easily mitigated now that the plant is being shuttered. The recent driving(8/2016) of sheet pilings at the east end of this island by CFAC to protect these lagoons and the water wells from the encroaching Flathead River is further evidence of the environmental risks this area presents. The drinking system built for this small city of people is also a problem in that contamination of production wells 3,4,and 5 over the years caused elevated risks for people on the site at unknown times. Wells 6 and 7 on the island are so shallow that it can be argued they are taking water from the Flathead River as they move up and down internally with the river elevation on a seasonal basis and the top of the water column insides the well casing is generally the same elevation as the river surface. Well 6 is in the same building as well 7 and less than 10 feet separate them horizontally and under 15 feet in each wells vertical depth yet well 6 routinely has had fluoride contamination levels 4 to 5 times higher than its very close neighbor. Should these wells remain in this environmentally

sensitive area that is always under serious threat from a minimally controlled major mountain river system.

Commented [AS15]: Without additional information, it is hard to follow this argument – but the concerns are valid – fluoride in GW and the effect of the ponds – whether by infiltration (maybe GW plume??) or solids that are picked-up and taken down-stream during storm events.

Finally the dumps and dry wells exist to handle unknown quantities of people waste with widely varying qualities and potential risks. We really don't know what, where and how much of any material placed in these facilities exist. They were created in an era of out of sight out of mind and this is a dangerous philosophy for constructing under-supervised and under- protected dump sites.

Commented [AS16]: Here is the crux of the whole problem, especially with older facilities. Waste piles, dumps, facilities, etc. maybe obvious or not obvious. Some documented, some not documented. Very valid concern.

I hope the above information provides you a glimpse at how important a technical understanding of the CFAC plants operating history can be in identifying hazards, places to look carefully and providing background information that will make future remedial action decisions easier and more accurate.

Comments on Phase 1 Site Characterization Addendum:

In this section I will reference the page in the book and then make comments I feel are important to the understanding of a specific topic being discussed.

A general comment about the addendum is that they reference animal tracks in many parts of the plant as part of their walk thru event. This property is a big game winter range and hosts a fair number of animals all year. It is used as a calving ground by deer and elk in the spring on the well island south of the plant and the open grass area by the current industrial dump as personally witnessed. There are both black and grizzly bears on this site in the spring and fall and a wolf pack uses this area now. This property is a valuable habitat for many animals big and small. In addition the forest service has asked the company to give permission to fertilize the face of Teakettle Mountain to improve winter forage conditions and Montana Fish and Game has asked the company to relocate Big Horn sheep to this mountain. All requests were refused because of fear of fluoride in vegitation and potential noticeable effects on animal dentition.

Page 6 Cedar Creek Reservoir Overflow

Why was the ditch built and why does it run thru the waste dump areas of the plant are the real questions. It was built to protect the dam that used to house the town of Columbia Falls water supply. It also protects a low area of housing on the edge of vetville. Prior to the dam construction in the early 1960's Cedar Creek would flood this area nearly every spring. The overflow allowed the water to be diverted out of the creek and dried this area so that houses now exist in the area. It also protected the dam from flood type conditions. Water is present in this ditch every year in a window that typically starts in April with lower elevation snow melt and ends in June with the spring precipitation volume dictating the end of flow. This ditch is in good condition but from personal knowledge it has breached at least twice that I'm aware of by being overtopped because the reservoir had to release a large but handleable volume by the ditch; but the uncontrolled and not measurable additions from the face of Teakettle sent it way over its capacity to flood areas upstream of the main potline building. Its location upgradient of all potline structures and dumps should be carefully studied as it is an outflow stream and can discharge huge amounts of water with the head pressure associated with water coming off the side of a mountain directly to the water table under this entire site.

Commented [AS17]: I hope the ditch and the "waste dump areas" are well-understood !!

Commented [AS18]: Wow – big potential source for cyanide.

Page 7- Flathead River

The company has made a decision to put drinking water wells and sewer/cooling water lagoons on this low lying island in the Flathead River. This is an environmental mess that will continue to cause problems. The North and Middle Forks of the Flathead River are uncontrolled upstream of this island and these are highly variable mountain rivers. In 1964 this river flooded and the measuring gauge in Columbia Falls measured 19 feet above flood stage. It would have been higher at this Island because it is at the mouth of a very steep Badrock Canyon which would have forced the water to increase in elevation to get thru this narrow gap. The 3 percolation ponds on this island were completely washed out as would be expected since they were originally created in the mid 1950's by building a dyke across the existing live river channel that flowed along this bank of the river. Water level at the PW-6 and 7 well house on the island was recorded at 6 feet deep inside the second story of the building. It washed out the dyke at the east end of the island and the company rebuilt it using local rock and covering it

Commented [AS19]: Other features that need to be well-understood, as mentioned before, could be sources of GW plumes.

with old concrete and steel floor slabs from the potrooms. These items didn't exist in 1955, they are an ugly and dangerous later addition. In August of 2016 the company further obstructed the river by driving a wall of steel sheet pilings across this dyke area. The river is trying to reclaim its river bed along this steep area and is washing the existing dyke away. Recent arials showing the river upstream and the eroding gravel bar are an ominous sign of things to come. This island should be vacated and everything coming from the plant above should be removed.

The next topic on this page is the seep and it is located just off the west tip of this island. Monitoring the water from the seep may not be enough and more may be gained by looking at two connected areas. The first is Production wells 1 and 2. They were in the area directly above the seep on the river. One was abandoned as a dry hole and the other lost to the rod mill construction I believe. Look at the well logs for these two. Could be interesting what the diggers found. I believe there is something different at the site of the seeps as they come out of the steep bank and then run across a grassy area that is about 3 foot above the Flathead River in late summer river elevation. This little plateau has some rock on it but the material directly under it is quite different and has a green to black hard shalley appearance. This most noticeable after spring runoff when drift fishing past this spot. This feature is unusual to this one spot as the river the rest of the way to Columbia Falls has neither this special grass cover or a elevated plateau from the river to the steep bank. It may not be bedrock but it is different and it is directly below the area where the only well of 7 drilled for water was dry. The other six are rated at 1500 gpm. It deserves more interest. I take exception also to the statement that the cliff to the west delineates the extent of the seep. There is another downstream to the southeast of the High School that may help with understanding the underground flow of water from the plant site and the Cedar Creek watershed. Another seep also exists upstream on the side of the bank and it empties into the southwest percolation pond. I suspect a walk from the seep along the base of the river cliff to the mosquito flats area of Columbia Falls will identify other seeps as well! Has anyone looked in the past 50 years?

Commented [AS20]: Could be valid concern or not.

Commented [AS21]: Recommend sampling seeps for fluoride. I believe fluoride is mobile but not super persistent.

Page 8 Landfills

A general comment on all of them at this point. Buying time and hoping that sampling the overall site will allow these sites to be listed as safe and minimize touching them in phase 2 is questionable. The nature and quantity of bad environmental chemical actors can be estimated now with sufficient accuracy by taking the manifests of what has been shipped by CFAC and subtracting it from the volumes that are recorded in the P&C monthly's and the purchasing records of the plant. Everything not manifested on the way off the site are in these dumps and folks will want to be sure they will never be released to come visit their water supplies. You should be doing Phase 2 work concurrent with Phase 1 so an accurate understanding and decision can be made on the fate of the materials in the dumps.

West Landfill cap extends over the top of the waste sludge pond and covers SPL and heavily contaminated basement sweeping that were dumped on the surface of the sludge pond. Both the west landfill and wet scrubber sludge pond could be up to 20 feet deeper than your estimates of current vertical heights.

Commented [AS22]: Sludge = source for PAH compounds with some fluoride and sulfate. SPL = primary source for cyanide mostly.

It is most unusual to find a concrete pad as part of the south asbestoes landfill. It may have been a homestead the plant bought to build the facility or something else. Find the aerial photographs and you will be able to identify when in was first noted and probably what it was used for.

Page 11- Percolation Ponds

The ponds were a direct injection method to take cooling water from the compressor building(1,255,000 gpd), liquid briquet cooling water from the paste plant mixer discharges(591,000 gpd), and the wet scrubber that scrubbed the off-gases from the paste plant mixers as they produced paste(66,700 gpd). The statement that the north-east pond has black soil estimated at 1 foot deep is wrong as is the assertion that this material is soil. It is coal tar pitch fines, petroleum coke fines and SVOC and VOC that were scrubbed from the mixer off-gas. It is not one foot deep but closer to 15 feet deep in the center of the pond. The deep water holes on the east and west of the pond were created with an excavator and all the

Commented [AS23]: All valid – primary concerns are PAHs, semi-vols, maybe VOCs but I doubt it.

material removed from these ponds is buried adjacent to this pond. There is no vegetation growth in either of these ponds because the chemicals in the water sterilized this soil.

These chemicals were intentional put into ponds designed to directly funnel their water to the underground water flows. Because coal tar pitch is know and regulated because it contains many chemicals known to cause cancer this site should be studied closer. Where did this water carry the carcinogenic chemicals. Is it now or in the future available to the downstream receptors of this water?

The northwest pond might be interesting to watch the next few spring to see if water refills part of the pond by coming from underground as many ponds along the Swan mountain front are filled. That would be important because the caps on all of the waste dumps above this area never considered underground water, just precipitation, in designing the caps.

Page 13- West Percolation Pond

This area deserves more than "downstream wells will pick this area up" and it is 29 feet deep with a pipe thru it. Which direction is downgradient? Why isn't it where the old drawing show it. Could it be it was under the parking lot that was put in this area when the workforce expanded to 1300 people in 1978-yes. More work needed here to because the water source wasn't just the change house showers. All of the drains in the laboratory hoods and sinks went to this percolation pond until the late 1990's. If you want an idea of what types of chemicals went down these drains get the manifest Steve Wright had to prepare when the lab was closed and materials were packaged and sent to an off-site repository.

Commented [AS24]: Wow – this could be anything !!!

South Percolation ponds have been discussed in the section on the Flathead River. They are contaminated by what went thru the sewage treatment plant and what was in the cooling water used to cool molten aluminum when it was being cast into sheet ingots. The metal in this water and the sludge on the pond bottoms were the impurities in the aluminum we produced or the alloying metals that were added to the casting aluminum holding furnaces and not in the individual cell taps as described later in this Addendum. Plant runoff came to these ponds and the northeast/west percolation ponds primarily. Flow to this pond system was variable

Commented [AS25]: So this is likely contact cooling water versus the current approach of using non-contact cooling water. There could be a variety of PAHs, metals, etc.

because of the differing pouring schedules in casting; but information I've seen from casting over the years indicated it varied between 1 and 3 million gallons per day. This volume plus the 1.9 million gallon per day from the paste plant area is why we had to run at least 2 of the 1500 gpm wells at all times.

The real question to answer, why should these contaminated water flows still be allowed to collect on a flood plain when the plant is shutdown. Water from the Flathead River has flown directly into and out of this system several times since they were sighted on this island.

Commented [AS26]: I do not fully understand this statement but it sounds ominous.

Page 14 Potline buildings

There has been no effort made to sample the area under the main production building and this is concerning as the potline basements are highly contaminated with fluoride as a minimum.

Commented [AS27]: Yep – anticipate that a lot of the concrete is very rich in fluoride. If demo'ed and used as fill, the concrete debris could become a source of fluoride to groundwater.

This area should be given more attention and not be filled in before assessing what is under this area.

To the point, contrary to your building naming there is no Casting Garage. The area at the north end of the casting facility was the maintenance garage before Line 3 was built in 1965. In 2002 oil was found in the electrical tunnel under the potline basement in this vicinity. There is a very high probability that single wall waste oil tanks exist under this area and they have contaminated this area. There was a large project to put triple wall fuel tanks in the area north of the main plant 20 years ago. There should be a lot of data in the engineering files about what was found, its disposition and status the tanks were left in. In addition the area just west of this was used as an oil storage area for years. It should be looked at. Finally a major diesel spill occured at the face of the old pitch unloading shed years ago. The plant locomotive was refilled there and this area should be suspect for underground fuel.

Commented [AS28]: Ok – besides the usual diesel fueling structures for all the vehicles on the facility, this statement raises the potential for PCB compounds to be present in oil associated with high-voltage structures – especially the rectifier (which converts =AC to DC) and the associated transformers – you have to understand these structures.

The discussion of cathode removal got me thinking about the challenges and safety of this task. It's not part of the RI in that respect; but I'm assuming the two 50 ton P&H cranes will have to be repowered and the cathodes dug before they can be safely lifted. You may want to have a complete safety inspection and structural analysis of the potroom floors done before

putting heavy breaking and lifting equipment on those deteriorated concrete structures. In a similar vein a safety inspection and structural analysis of the steel structure of the potroom building is long overdue. The last one done was around 1990 and it found many of our structural support columns physically damaged and strong evidence of fluoride attack on certain structures. The building may not be structurally safe to lift 100 ton loads anymore with all the years the fluoride has had to work on the shutdown areas since 2000.

Putting power to the crane rails may have some unintended consequences as well because the plant has an interconnected ground mat and work in the rectifier yard or elseware could become more dangerous for employees without their knowledge.

Why are all the piles of highly contaminated salvage material left outside to add further pounds of leached fluoride to the groundwater?

Page 15 Rectifier Yard

There have been spills of PCB contaminated oil on the ground in this yard. Operating parameters allowed this transformer oil to be contaminated way above the current 50ppm threshold for classifying it as a hazardous waste. This oil was used on all of the roads north of the plant and on top of the landfills as a dust suppresent. One transformer burned down around 1990 and release a cloud of burning transformer oil into the air for several hours. One major concern at the time was how much dioxin was produced in this cloud. It was written up in a document that to this day claims the transformer was in the west rectifier yard. Look in the EAST rectifier yard south of room 8 if you want to find the actual site.

Commented [AS29]: Here we go – PCBs and potential dioxins.

The ground mat under this area is extremely dangerous and BPA is still capable of using this substation today.

Finally the rectifier technology used in the 1950's was pre-diode. It was mercury rectifiers and it contained a lot of mercury that was volatilized when adjustment in operation were made. Calbag had to decontaminate the east rectifier station as part of decommissioning this facility.

Commented [AS30]: Through in Hg and maybe other metals. This is an old facility!!

The question I have if they still found contamination in the building 50 years after it was cleaned up where is the original equipment that wasn't cleaned, but probably dumped in one of the out of sight out of mind dumps on the north end of the plant. Mercury is a very mobile and dangerous substance. Where is it if it existed at all?

Page 17 Background Area

Why was this area picked. The top 12 to 18 inches of the natural topsoil was removed down to the underlaying gravel in 1994 and used to cover the west and east landfills. It is a questionable choice for a background information soil sampling point.

Page 18 Existing wells

Appendix B pictures say it all in this section. These wells were the data points that were used for data collection points to prove the plant was meeting all of the conditions of its permits. It looks like the same day you let the plant fall into disrepair and visually fall apart was also what was done with these important wells. Care for the surrounding community fell out of bed that day and then to claim trespassers had access to the wells. CFAC did nothing to protect these well heads intentionally. Later in this report there is an assertion that future data from these wells should literally be disreguarded as is the following paragraph that says future data from PW-3,4,5,6, and 7 should suffer the same fate because it will cost some money to either get power back to them or we can't sample them. Why can't low flow downhole sampling give correct data as it does in the other existing wells or simply pull the internals and sample them in this manner. It doesn't affect the final future disposition of the wells it just keeps them a cheap useable, historical source of certified data.

There is a lot of historical data from these wells that were the basis for operating and discharge permits, dump liners etc. Keeping all the existing well samples viable and comparable to the new sampling the next four years will provide more data to try and ascertain where the water contamination problems are coming from etc.

Page 25 Soil Gas Screening

Commented [AS31]: I never heard of soil gas as an issue for an aluminum smelter – unless there is buried spent potliner and there are concerns for cyanide and related gases.

The table presents data that is hard to accept or understand.

The center landfill numbers are high in VOC but no methane from the cleanest source of buried material. It is 100% SPL. The west landfill has several times the volume of SPL buried inside of it plus lots of tons of potline anode gas catch which is a concentrated organic fume catching product; plus lots of solvent wastes and lunchroom waste yet it has no methane and very low VOC. It should be magnitudes higher than the center landfill based on what is there and its large volume. Finally the 10 west landfill vents were designed into this structure because the engineering firm based on onsite confirmation of the wastes in this dump felt it needed venting because they anticipated it would generate methane primarily for 30 plus years much like a municipal landfill. Unvented the gas would lift and destroy the PVC liner in their opinion.

The data doesn't begin to match what common sense would lead one to believe.

Page 26 Passive Soil Gas Sampling

The fact that Benzene and Trichloroethene were found is not surprising because the laboratory used large volumes of Benzene when doing carbon studies and analysis and the Trichlor compound was a favorite with the electrical staff in the rectifier and maintenance area as a cleaning agent for parts and hands.

Commented [AS32]: Ok – if solvents used for cleaning, then potential concern for these in soil.

The last comment I will make because the addendum document is due back at the library in 15 minutes concerns the Roux drawing of the main site plan and drainage document in the pocket at the rear of the book. You are showing the drainage line from the wet scrubbers that were used to control fluoride and organic pollution from the potrooms for the first 22 years of the plants' existence by-passing the scrubber water treatment plant and then going to dump into the northeast percolation pond. This is completely wrong. It went to the treatment plant for neutralization and precipitation and the effluent is what filled the wet scrubber sludge pond.

I hope you will see the value in forming a technical group that concentrates on building the knowledge base for the facility so that sampling work that gets done generates the best possible information. This same group would also be an experienced analytical source for

evaluating the data from this sampling effort that would compliment your other technical contractors. There is value here if you are really serious about community involvement that is meaningful.

Nino