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October 3, 2018

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2195 E Front Street
Logan, OH 43138-8637

Subject: Questions about the draft Remedial Investigation/Feasibility Study for the Former Satralloy Site – Slag Metallurgy and Cronimet Treatability Study

Reference: Remedial Investigation/Feasibility Study for the Former Satralloy Site dated December 2016

Dear Ms. Galanti,

We are disappointed that almost three months have gone by since sending the first of our five letters (via certified mail with confirmed delivery) and to date not one of them has been answered. Why are you not responding?

We see that there was a Consent Order related to the Satralloy Site signed between the State of Ohio and Cyprus Amax Minerals Company (a wholly owned and controlled entity of Freeport McMoRan) for the Satralloy Site in November 2010. Here is an excerpt from the first page:

CONSENT ORDER FOR PRELIMINARY INJUNCTION TO CONDUCT A
REMEDIAL INVESTIGATION AND FEASIBILITY STUDY AND TO PAY
RESPONSE COSTS

Plaintiff, State of Ohio, ex rel. Richard Cordray, Ohio Attorney General ("Plaintiff"), filed the Complaint in this action, at the written request of the Director of the Ohio Environmental Protection Agency, under the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, 42 U.S.C. §9601 et seq. ("CERCLA"). Plaintiff and Defendants, Cyprus Amax Minerals Company and Chemetall Foote Corp., have agreed to the entry of this Consent Order for Preliminary Injunction for Remedial Investigation and Feasibility Study ("COPI");

We have been reading on the OhioEPA website about the CERCLA process. There is a lot of information about what is supposed to be taking place with regards to the investigation and remediation of the Satralloy Site. It appears a lot of the requirements are being followed but one aspect of this CERCLA process that the OhioEPA could do a

whole lot better at is public communication. We are requesting you start complying with all the CERCLA requirements for public communication. Such as responding to written inquiries within 28 days.

The COPI is almost eight years old and we have not seen one public meeting held about the work being done, not one bit of correspondence about this project has been sent by the OhioEPA or Freeport McMoRan to the surrounding neighbors. There have been no Town Hall style meetings, no FACT Sheets, no public repository and no annual status report! So why is this? We would appreciate it if this oversight could be addressed as a matter of urgency.

The closest thing to public outreach was in 2013; the Freeport McMoRan Project Manager, Barb Nielsen, spoke to a group of First Responders at the Hilndale Fire Station and promised that a Freeport McMoRan produced Satralloy Site website would be set up with all the reports, laboratory information, studies, data, etc. stored on it and be made available to the public. Well that was five years ago and NOTHING has happened. Can you ask the Freeport McMoRan Project Manager to live up to her commitments?

We do appreciate you have put information on your OhioEPA website. It took us some time to find it but now that we have downloaded all the information we can at least ask important questions about the Site. For now we are focused on why so little apparent action has been taking place on some very serious deficiencies in the Freeport McMoRan Remedial Investigation/Feasibility Study for the Former Satralloy Site dated December 2016 (RI/FSforFSS).

A letter from the OhioEPA to the residents of Cross Creek and Wells Townships with instructions on how to access the OhioEPA website and download the data regarding the Satralloy Site would be a good first step toward letting the public have a better knowledge of the project. What would be even better would be a public repository set up at the Steubenville Public Library with all the Satralloy Site documentation on file.

We have written to you in the previous four letters and one letter to Kristy Hunt about many concerning issues with the (RI/FSforFSS). As our group evolves and talks to other people in the community we find we have a number of neighbors with knowledge of the former Satralloy Operations and their conclusions after reading the investigative and laboratory data are much different than the authors of the RI/FSforFSS.

Another area that stands out to some of our group is the authors' discussion about the Satralloy Slag. There are a number of inconsistencies in the ferrochromium slag conclusions provided in the RI/FSforFSS. Once again, as we have pointed out in our previous letters, the conclusions stated by the authors of the RI/FSforFSS are out of line with the data provided in the report. There are a number of contradictions in the report about the ferrochromium slag. Why have you not called these out?

We have included excerpts from the RI/FSforFSS. It appears that Freeport McMoRan did a lot of research work. Their conclusions in many places just seem to ignore their own research work when they state that there are no health and safety issues at the Satralloy Site. These conclusions are in contradiction to their own data. We sincerely hope that the OhioEPA is making sure these unsupported conclusions will not be accepted. It may be of no consequence to OhioEPA personnel who live in Logan or Columbus but we really wish you would demonstrate to the local public your obligation to look out for the health, safety and welfare for the people, flora and fauna that live, play, work and worship around the Satralloy Site.

We have copied the below excerpts from the RI/FSforFSS in underlined italics and then have added our responses in bold font. We are requesting your answers to our questions and please give as strong as consideration to our comments as you do the authors of this report.

Background information related to ferrochromium slag from the RI/FSforFSS:

3.3.2 Mineralogical Study

*In August 2008, slag sampling was performed for mineralogical characterization at the Site to determine potential use/reuse of the slag. The objectives of this sampling program were 1) to gather information regarding the type(s) of slag present at the Site, 2) to determine the distribution of each slag type identified, and 3) to provide slag samples to Cyprus Amax for subsequent analysis of the slag's metal content. A total of 48 hand auger/shovel samples and 46 samples from drilled borings were collected and provided to Cyprus Amax for **commercial evaluation** (locations in Figure 3.3-2). In addition to the mineralogical analysis, 17 samples from nine soil borings (FMA-20, FMA-24, RT-11, RT-19, RT-24, RT-29, RT-36, RT-40 and RT-50) were selected for environmental laboratory analysis of total chromium and Cr(VI). These sample locations are described in Table 3.4-1 and shown in Figure 3.3-3.*

Response and questions from the Friends of Kolmont:

What do the authors mean by "commercial evaluation"? This sampling work was done over two years before the COPI was signed in November 2010. Was the slag being evaluated for commercial value and not being evaluated for remediation? Was the analysis being done by an accredited lab that the OhioEPA had approved? Would OhioEPA please put these lab reports onto your website? How can OhioEPA accept all this data as applicable for remediation evaluation when it was collected and tested for commercial purposes? The environmental analysis for FMA-20, FMA-24 and all the RT samples noted in the paragraph above and as shown in Table 4.1-1A state the Hexavalent Chromium levels all exceeded the USEPA Residential and Industrial Regional Screening levels. This was not mentioned in the RI/FSforFSS. It seems any and every negative lab result shown in the tables (and there are a lot) have been completely ignored by the authors of the RI/FSforFSS!!!

3.3.3 Scoping Study

As part of the 2006 Scoping Study, 24 slag samples were collected representing the range of slag types at the Site. Sample locations (SLG-X) are described in Table 3.4-1 and are shown in Figure 3.3-3. A report documenting the Scoping Study was submitted as Appendix C of the RI/FS Workplan.

3.3.4 Slag Borings

In 2014, slag samples were collected representing the range of slag types and chromium concentrations previously identified. The RI/FS Workplan proposed eight surficial slag sample locations. After reviewing prior slag data and vertical profiles, the proposed sampling was modified to include subsurface samples (SLGBH-01 through SLGBH-06) so that the full range of chromium concentrations in prior data would be included. In addition, native soil beneath the slag was also sampled. One slag boring (SLGBH-05) was planned in the Former Mine Area; however, access road conditions prohibited safe access for the drill rig at that time due to excessive rain. Instead, SLGBH-05 and SLGBH-06 were drilled in a Site road where ore and slag had been used in road construction. The six slag borings (SLGBH-01 to SLGBH-06) were drilled from ground surface vertically downward until native soils were encountered. After the cores were logged, they were field screened for heavy metals using an X-ray fluorescence (XRF). Field screening was performed at odd-numbered feet depths (i.e. one-foot, three-foot, five-foot, etc.) as well as at visually identified changes in lithology or color. The XRF field screening results are included on the slag boring logs (Appendix G1). Five samples were selected for analysis of total chromium to confirm relative concentration distributions exhibited by XRF field screening results prior to selecting final samples for full analysis, followed by selecting 12 slag samples for full analysis, including: total metals, Cr(VI), total chromium by Synthetic Precipitation Leaching Procedure (SPLP), paste pH, and mineralogy. In addition, four samples of native soil immediately beneath slag at borings SLGBH-01 through SLGBH-04 were analyzed for total metals and Cr(VI) to check for possible downward vertical migration of those compounds.

Response and questions from the Friends of Kolmont:

Per the verbiage above, all slag testing reported by Golder Associates appears to have been collected between 2006 (24 surface samples), 2008 (48 hand augured and 46 drilled boring samples) and 2014 (22 subsurface samples). So over an eight year period, 140 ferrochromium slag samples were collected and analyzed. In looking at Tables 3.4-1, 4.1-1A, 4.1-1B and 4.1-1C only 13 of them (9.3%) were shown deeper than 5 feet.

So all these surface samples (~90%) were taken from slag that has been through decades of seasonal cycles of rain, freezing (ground cracking and fracturing), thawing and drainage. In the authors' of the RI/FSforFSS own words they state that the ferrochromium has been leaching from the slag for decades downward from the surface level. Has OhioEPA questioned why Freeport McMoRan did not take more representative deep samples? We are wondering why the percentages were not the opposite; why weren't over 90% of the samples collected and analyzed for Hexavalent Chromium below the 5 foot surface level. Is it because if you do not sample where there could be bad news you can report there is no bad news?

Freeport McMoRan states they collected 140 ferrochromium samples but in their data tables (4.1-1A thru 1C) it clearly shows they only tested for Hexavalent Chromium on 39 samples. Why was Hexavalent Chromium only tested for less than 28% of the samples? Of those 39 samples almost every one that had been tested had a Hexavalent Chromium laboratory result much greater than the USEPA Residential Regional Screen Limits of 0.3mg/kg and Industrial Regional Screening limit of 6.3mg/kg. Why did the authors of the RI/FSforFSS not mention this?

Let's also talk about how limited the ferrochromium sampling actually was to represent the Satralloy Site. In Section 3.3.4 of the RI/FS for FSS the authors make it sound like they did an extensive job of collecting samples to reflect the ferrochromium slag at the Satralloy Site. They state... "In 2014, slag samples were collected representing the range of slag types and chromium concentrations previously identified. The RI/FS Workplan proposed eight surficial slag sample locations. After reviewing prior slag data and vertical profiles, the proposed sampling was modified to include subsurface samples (SLGBH-01 through SLGBH-06) so that the full range of chromium concentrations in prior data would be included. In addition, native soil beneath the slag was also sampled." So how is it, in getting this full range of data they selected one of the samples SLGBH-01 to be collected under the rail spur. A rail spur that was constructed before the plant was put into operation. It is common knowledge among local Engineers when industrial sites like Satralloy are being constructed they use steel slag from close by steel mills for backfill and foundation material. If you ask the Golder Geotechnical and Civil Engineers they will most likely confirm this is the case. Does it make sense that ferrochromium slag would be stockpiled in significant quantities under the rail spur before the Satralloy facility was even built? How can you put ferrochromium slag under a rail spur that needs to be put in place first to build the ferrochromium process facility even begins to operate? Most likely the samples collected from SLGBH-01 were not even ferrochromium slag. We know there was period of no rail spur and then a new one was installed on the previous route by Freeport McMoRan but again what relevance does this location have to do with representing the ferrochromium slag piles at the site? Did Freeport build the new rail spur using ferrochromium slag they knew had Hexavalent chromium leaching out of it?

The same relevance question for the samples collected at locations for SLGBH-04 and SLGBH-05 both of which were less than 5 feet deep and taken in the middle of plant roads. How can these be representative of the ferrochromium slag stockpiles at the Satralloy Site?

So three out of the six locations targeted in 2014 to define the ferrochromium slag better that were selected by Golder Associates and/or Freeport McMoRan Engineers were not even in ferrochromium slag pile locations. Freeport used as an excuse for these plant road sampling selections were the result of bad weather and poor access to the ferrochromium slag piles.. Why not wait a few days and then get the samples from the ferrochromium slag piles? Is their reason as really as pathetic as it sounds? Freeport McMoRan is informing the OhioEPA that it is a valid excuse to deviate from an approved workplan because of some raindrops? It seems like a very weak excuse to avoid taking samples where there is most likely bad news.

Of these three remaining locations that were deeper than five feet, there were 12 slag (non-native soil) samples collected and the average Hexavalent Chromium

laboratory results for these were 67.9mg/kg. This is over 10 times the EPA value of 6.3mg/kg for Industrial Regional Screening Limit and 225 times the EPA value of 0.3mg/kg for Residential Regional Screening Limit for soils. So it appears the few times they actually took samples from representative locations and actually ran tests to determine Hexavalent Chromium levels the results were very, very high. This seems to support the theory quite well that Freeport McMoRan and Golder Associates wanted to severely limit representative sampling in the ferrochromium piles? We hope it is setting off alarm bells in the OhioEPA that the only 3 truly representative locations sampled after the COPI was signed had Hexavalent Chromium values blowing the lid off USEPA safe limits.

Again the authors of the report try to give them impression they are doing all this meaningful, representative work but let's look at the 17 samples reported in Table 4.1-1A. Every one of those were collected at depths of less than 5.33 feet with an average depth of less than 2 feet. So how valid is this surface based information to be representative of the leached ferrochromium slag? More on this below.

So again for all the impression the authors are attempting to present by listing these 140 ferrochromium slag samples from dozens of locations; there was only 3 actual representative locations where Hexavalent Chromium content was reported taken at depths over 5 feet. That is an average of less than one representative sample location per 100 acres of the Satalloy Site. This is a pathetic representation of the ferrochromium slag at the Site. We hope the OhioEPA is calling this into question. This cannot be consistent with the spirit of the workplan.

For the authors of this RI/FSforFSS to categorically state there is no health or safety issues from this Site when the only three truly representative slag locations have Hexavalent Chromium lab results exceeding 10 times the Industrial Regional Screening Limits and 225 times the Regional Screening Limits for soils is absurd.

We ask OhioEPA if they accept this pittance of representative sampling to be sufficient to support the Conceptual Site Models and Risk Assessments done by Freeport McMoRan and their Engineers in the RI/FSforFSS. Especially since the truly representative data indicates a potential for serious health and safety concerns.

4.1 Slag

Chromium ore processing operations generated slag, which was deposited throughout the Site. The extent of slag deposition is discussed in Section 3.3.1 and shown approximately in Figure 3.3-1. A total of 64 slag samples were collected from 24 slag surface locations and 15 slag borings during the Scoping Study, Mineralogy Study, and RI activities (see Section 3.3). Analytical results are provided in Tables 4.1-1A through C and in Figure 4.1-1. Mineralogical results are presented in Tables 4.1-2 A and B. Key characteristics of the slag include:

- Detected total chromium concentrations ranged from 20 to 18,000 mg/kg with a median of 1,280 mg/kg (64 samples).
- Cr(VI) ranged from 0.43 to 270 mg/kg with a median of 13.2 mg/kg.
- Mineralogical analyses did not identify discrete chromium-bearing minerals in any samples. The results indicate a predominance of calcium silicates (Ca_2SiO_4 and Aegirine [$\text{Ca}_3(\text{SiO}_3\text{OH})_2 \cdot 2\text{H}_2\text{O}$]), spinel (MgAl_2O_4) and calcite (CaCO_3). Amorphous (glass-like) material (10% to 40% by weight) was found in most samples and is a potential host for chromium. The Friends of Kolmont call a flat out misleading and misrepresentation in this yellow highlighted statement. How can their mineralogical analyses not identify discrete chromium-bearing minerals? What is presented in Table 4.1-2A showing 35% of the ferrochromium slag material as unknown amorphous material is nothing short of intentional deception. We hope OhioEPA sees this for what it is. More on this below.
- SPLP leachate concentrations of total chromium ranged from 0.023 to 0.54 mg/L with a median of 0.14 mg/L (12 samples).
- Concentrations of arsenic ranged from 0.3 to 56.8 mg/kg with a median of 2.65 mg/kg (36 total samples). Concentrations of manganese ranged from 83 to 7,530 mg/kg with a median of 291 mg/kg (36 total samples).

COPCs other than chromium are present in slag; however, the discussion focuses primarily on chromium because of the mobility and toxicity of Cr(VI). The slag data indicate that total chromium is present at concentrations well above background. However, Cr(VI) accounts for a very low percentage of the chromium found in the slag (i.e., median value of 3.7% of the total chromium content). We consider where Freeport McMoRan actually collected realistic ferrochromium samples the lab results showed 100% exceedance of Hexavalent Chromium at ten times the Industrial Regional Screening Limits (6.3mg/kg) and 225 times the Residential Regional Screening Limits (0.3mg/kg). How can presence of so much Hexavalent Chromium not be a significant potential health problem at the Satralloy Site?

The mineralogical analyses did not identify discrete chromium-bearing minerals; the amorphous fraction is the likely host of chromium. Consistent with the low Cr(VI) content, chromium in the amorphous phase is expected to be present as Cr(III) because chromium occurs in the trivalent state in the original ore, and the smelting process through which the chromium is extracted and slag is generated takes place under reducing conditions favoring the formation of Cr(III). Please call Test America (like we did) and ask to talk to any of their qualified technical people and they will explain if they are sent a quality representative sample of ferrochromium slag they can give you a complete and detailed breakdown of every mineral component of the sample. They will not say one third of the sample is amorphous material. Test America will tell you if for the rare, rare chance they could not get a complete, detailed breakdown they would ask for another sample to be sent so they could provide this.

Freeport McMoRan is reporting that this minerology work was done in 2008 yet they did not take ownership of the property until 2010. Why was there no minerology test done after the COPI was signed? Is that not a reasonable presumption? Who collected these samples and what lab tested them? Is Golder Associates and Freeport McMoRan reporting and making conclusions on non-validated data? Please ask Freeport McMoRan to provide documentation from the laboratory that did the 2008 minerology report on the Satralloy Site ferrochromium slag. Was this a certified laboratory or was it done "in-house" by Freeport McMoRan?

In Table 4.1-1A, 9 out of the 17 samples shown have a foot note that the "Sample was received and analyzed past holding time". How far past the holding time were the samples received? One day, one week, one month, one year? Again we ask, are these samples which were taken for commercial purposes valid for environmental remediation investigation evaluation?

Also how can Freeport McMoRan and/or their Engineer, Golder Associates tout all their slag interpreted XRF work as valid if they did not have a complete and detailed breakdown of the mineralogy to calibrate their XRF equipment? If this XRF work is based on a mineralogy breakdown with one third of the sample being amorphous all that work should be called into question. If the XRF equipment was validated on complete and comprehensive mineralogy work why was this information not reported in the RI/FSforFSS?

Please look at Table 4.5-1A there is 9 pages of data on 79 test pit soil samples that Freeport McMoRan and Golder Associates elected not to analyze for Hexavalent Chromium. Why was this?

Please look at Table 4.5-1B – what is the relevant purpose of this table if they did not test for Hexavalent Chromium? It looks like they just wanted to show they collected a lot of data but again for what purpose?

Please look at Table 4.5-5A – there are very high Total Chromium numbers (indicators for high Hexavalent Chromium) for samples taken at depths below a few feet but the first 88 samples in this 9 pages of data were not analyzed for Hexavalent Chromium. It is only on the last page of this table that they show Hexavalent 8 samples with Hexavalent Chromium results and all of these are in exceedance of USEPA Regional Screening Limits. Does the OhioEPA feel like there is a pattern of selective analysis work being done by Golder Associates and Freeport McMoRan?

We did see on the website a letter from Barbara Nielsen to you dated October 5, 2016 it states... "In order to develop data on potential treatment and resource recovery at the Former Satralloy Site (Site), Cyprus Amax Minerals Company (Cyprus) proposes to perform a Treatability Study at the Site. Attached is a workplan for your review."

We have reviewed the attachment to Ms. Nielsen's letter. We find it very interesting. It shows 35 locations of ferrochromium slag samples being identified in the actual slag stockpiles. It talks of processing procedure that will take metals out of the ferrochromium slag. What does the sampling data look like from these 35 ferrochromium slag sample locations? Why wasn't this information included in the RI/FSforFSS? Is the lab data from these 35 sample locations consistent with the three representative stockpile samples (SLGBH02, 03 and 04) taken by Freeport McMoRan?

We see there is response to Ms. Nielsen's letter with regards to the Treatability Study in a letter dated October 13, 2016. OhioEPA wrote to Barbara Nielsen of Cyprus Amax Minerals Company stating... "The treatability study describes the procedures for which the slag will be excavated and treated to evaluate the feasibility of extracting certain metals at the former Satralloy Site, Jefferson County, Ohio. The treatability study is expected to last approximately four months with the results being used to evaluate remedial alternatives. Ohio EPA approves the treatability study in accordance with the requirements of the 2010 Consent Order and looks forward to the results."

We looked up the 2010 Consent Order and saw under Appendix L a description of what is to be included in a treatability study. We assume that Freeport McMoRan has provided you with that treatability study in accordance with Appendix L of the COPI.

This letter has been a work in progress taking weeks to compile the points above. So now as we return to this letter, a brief update,..... we have found on your website what looks to be a partial Treatability Study (TS) report dated July 2017 done by Cronimet Mining. It seems to match up with the Barbara Nielsen letter to OhioEPA of October 13, 2016 workplan request. This Cronimet TS report does not comply with all the documentation required in Appendix L of the COPI so we assume this is a preliminary draft report. Has OhioEPA received the final report? If not has OhioEPA asked Cronimet or Freeport McMoRan to provide a full report meeting the criteria required per Appendix L of the COPI? Copy of Appendix L is attached.

In looking at this preliminary report from Cronimet they have taken 35 samples from the actual ferrochromium slag stockpiles but it does not provide any detailed information as to how deep the samples were collected. Could you ask Cronimet and/or Freeport McMoRan for that information?

In Appendices H and I of the Cronimet TS report they have a very detailed breakdown of the mineralogy of the ferrochromium slag. How is it they were able to get a complete breakdown of the ferrochromium slag mineralogy and Golder Associates and Freeport McMoRan could not? Can this Cronimet information be used by Golder Associates and Freeport McMoRan to make up for the inability of their lab(s) to determine this?

In the Cronimet TS report on page 9 it said they used accredited laboratories to analyze their samples. We did not see a similar statement in the RI/FSforFSS. So we ask again, were accredited laboratories used by Golder Associates and Freeport McMoRan when doing all their mineralogy determination work? We are pursuing this topic because in so many places the authors of the RI/FSforFSS claim they could not get complete information but make sweeping conclusions about the ferrochromium slag and arc furnace dust that are not even supported by their own data. Here we see a partial TS report in what appears to be done by someone other than Freeport McMoRan or Golder Associates and the data seems to contradict what was presented in the Golder Associates tables. It appears contrary to the Golder Associates table that is you can get detailed mineralogy of the ferrochromium slag, which is consistent with what Test America told us. It appears that Golder Associates did not want to go to this effort or had other reasons not to show this information.

To demonstrate this point further, please compare information shown on the mineralogy of ferrochromium slag in Table 4.1-2A from the RI/FSforFSS that shows for 25 samples analyzed by Golder Associates there was an amorphous component that comprised 10-45% of the samples. It show the mineral content of that amorphous component was a big question mark (i.e. the lab could not identify it) and there are another 16 mineral components that could not be identified or were unknown. The mineralogy breakdown in Appendix H and Appendix I of the Cronimet TS report seemed to use a laboratory that knew how to do a proper job of identifying the mineralogy of the ferrochromium slag. There were no question marks to the mineral content, no extensive list of amorphous, unidentified or unknown minerals just a complete listing of each mineral breakdown. It is also interesting to note in the Cronimet table the mineral content was detail showing the breakdown to the thousands of unit weight where the Golder Associates Table 4.1-2A shows the mineral content rounded to whole numbers. Has the OhioEPA questioned the shoddy information in Table 4.1-2A? We hope the OhioEPA has not accepted the mineralogy work provided by Golder Associates?

How can the Golder Associates Table 4.1-2A which is supposed to depict the mineralogy of ferrochromium slag not even show an identified chromium mineral? How can OhioEPA accept the ferrochromium slag mineralogy work done by Golder Associates if they cannot do this?

If the Cronimet collected ferrochromium samples went down more than a foot (unlike the vast majority of the Golder Associates collected samples) maybe what Cronimet did is a more accurate representation of the ferrochromium slag at the Satralloy Site. If this is the case (we hope so) then when OhioEPA gets the complete TS report from Cronimet there may be some representative ferrochromium slag data.

There seems to be more data and information that Cronimet should have that is not shown in this Treatability Study. Where are their lab reports? The RI/FSforFSS was full of the authors' opinion throughout the document but Cronimet is almost silent on their opinions or interpretation of the data in their report. Again we go back to them not complying with the components required per Appendix L of the COPI. We have the following detailed questions about the Cronimet TS report that we would like answered:

- Can Cronimet elaborate on how they would process the water to remove the Hexavalent Chromium?
- It does not look like Cronimet tested any of the ferrochromium arc furnace dust. Did they, if they did where is that data? If not, can Cronimet process the ferrochromium arc furnace dust to remove the metals? If yes, can they confirm in doing this, will it make the toxic furnace dust non-toxic?
- Appendix B – Sample Location Table: Please give depths that these 35 samples were collected from
- Appendix C – Particle Size Distribution: Why were these samples crushed to these sizes? What is the reason for this?
- Appendix D – Metal Recovery: What do these results mean? Is this good news for removing ferrochromium from the slag? What do these results mean for the potential to the metals processing at the Satralloy Site?
- Appendix E – Microscopic analysis: What is the interpretation of these photos? Are these positive pictures from the aspect of removing the ferrochromium from the slag?
- Appendix F – Metallurgical Analysis Recovered Metal: What is the interpretation from this table? Is this good news for removing ferrochromium from the slag? What do these results mean for the potential to the metals processing at the Satralloy Site?
- Appendix G – TCLP/SPLP Processed Slag: What is the interpretation from this table? Is this good news for removing ferrochromium from the slag? What do these results mean for the potential to the metals processing at the Satralloy Site? Is their information on how well this process by Cronimet will remove Hexavalent Chromium from the slag?
- Appendix H - Mineralogy of Processed Slag: Did Cronimet perform a mineralogy test on the slag samples before they were processed? If they did could they please provide them to OhioEPA and us, if not could they still do a mineralogy test on this pre-processed slag and provide it to interested parties?
- Appendix I – Mineralogy of Slurry Tower Area Slag: Why did Cronimet show this mineralogy as separate?
- Appendix K – Totals Metals Process Water: What is the interpretation from this table? Is this good news for removal of Hexavalent Chromium from the slag? What do these results mean for the potential to the metals processing at the Satralloy Site? Cronimet talks about removing Hexavalent Chromium from the process water in Section 4.2 of their TS Report by stating.... "In the full-scale CRONIMET solution, the

Process Water will be recycled in a closed circuit (i.e., zero effluent) water treatment plant that includes a Cr (VI) neutralization step. After the FeCr is removed from the slag and Cr (VI) dissolved into the Process Water, non-toxic ferrous sulfate is used to reduce the Cr (VI) to Cr (III), which is then precipitated out of solution and collected as Filter Cake.” Does the OhioEPA agree with this statement? Does this mean they will keep all their process chemicals, especially Hexavalent Chromium, in a closed circuit to prevent discharges to Cross Creek? If the ferrochromium slag is processed by this “Cronimet Solution” will it be able to stop the current, uncontrolled surface water discharge of Hexavalent Chromium into Cross Creek? Is there proven technology to back up Cronimet’s claim here?

- Appendix L – Cr(VI) Process Water: What is the interpretation from this table? Is this good news for removal of Hexavalent Chromium discharges from the Satralloy Site? What do these results mean for the potential to the metals processing at the Satralloy Site?
- Appendix M – Air Quality Monitoring: What is the interpretation from this table? Is this good news?

Cronimet states... “The results from the TS confirm that the CRONIMET process will successfully separate the metals from the slag and that the FeCr can be beneficially reused as a valuable commodity. The Cr (VI) can be processed as part of the CRONIMET solution. The Processed Slag may be considered for other on-Site or off-Site uses. This TS supports the evaluation of the technical feasibility and economic impact of implementing the CRONIMET solution to recover the metal on the Site and neutralize Cr (VI) as part of the remediation and restoration of the former Satralloy Site.”

If this is correct than it should seem this Cronimet solution process should be given a very serious consideration for remediation of the Satralloy Site. This process would remove the Hexavalent Chromium generating component from the slag (i.e. the ferrochrome) and sell it. What chemicals would be used by Cronimet to achieve this? Will they just create another set of environmental issues taking the ferrochrome out of the slag?

What does Cronimet really mean in their conclusion when they talk about the ferrochromium can be beneficially reused as a valuable commodity. Can it be sold to steel mills for production of stainless steel like was done from the original operation? Can Cronimet elaborate on how the Processed Slag may be considered for other on-Site and off-Site uses? Does this mean the ferrochromium slag can really be processed so it is no longer a health hazard? It would be a comforting thought that over 2 million tons of this health hazard eyesore could actually be partially and/or fully removed from the site.

Please ask Cronimet to expand on their Conclusions and Recommendations (Section B of Appendix L of the COPI) and Results and Discussions (Section D of Appendix L of the COPI)

We really hope your lack of response to our past letters is not from a lack of effort or deciding to ignore the basic founding principles of the OhioEPA and you are actually going to take visible action in a timely manner (i.e. your 28 day mandated response time). We look forward to your soonest response. Like our multiple past requests could you please post your detailed replies to us on your Ohio EPA website?

We have spent a lot of time and effort in putting all these letters together for you and Kristy Hunt. We are looking for specific responses to our questions. Please do not disrespect us with a lot of generic, non-specific, buzzword, shallow or evasive answers. And please do not give us a global response that you are looking into this and will respond shortly. Most of questions we have asked you should have been able to answer straight away and all of them in the two plus months we have been waiting.

Sincerely,

Friends of Kolmont

Attachments:

RI/FSforFSS Table 4.1-1A with comments
RI/FSforFSS Table 4.1-1B with comments
RI/FSforFSS Table 4.1-1C with comments
RI/FSforFSS Table 4.1-2A with comments
RI/FSforFSS Table 4.1-2B with comments
RI/FSforFSS Table 4.2-1 with comments
COPI Attachment L with Comments

Table 4.1-1A: Slag Analytical Results - Mineralogy Study

Location	Depth (ft)	Date	Parameter Units	Chromium, Hexavalent	Chromium, Total
FMA-20	0.83 - 1.67	8/22/2008	mg/kg	< 15.7	1870
FMA-24	0.83 - 1.67	8/22/2008	mg/kg	32.0	2450
FMA-24	2.08 - 2.25	8/22/2008	mg/kg	< 11.2	30.4
RT-11	C - 0.83	8/18/2008	mg/kg	< 12.8 H3	3040
RT-11	1.67 - 2.5	8/18/2008	mg/kg	19.0 H3	1590
RT-11	3.33 - 4.16	8/19/2008	mg/kg	< 14.3 H3	1370
RT-11	4.92 - 5.33	8/19/2008	mg/kg	< 11.9 H3	20.0
RT-19	C - 0.83	8/19/2008	mg/kg	< 14.6 H3	975
RT-24	0.83 - 1.67	8/19/2008	mg/kg	13.2 H3	2360
RT-24	1.67 - 2.5	8/19/2008	mg/kg	16.1 H3	1270
RT-29	2.17 - 2.42	8/20/2008	mg/kg	< 14.7 H3	615
RT-36	C - 0.83	8/21/2008	mg/kg	< 13.7	1120
RT-36	2.5 - 3.33	8/21/2008	mg/kg	< 15.8	1230
RT-36	3.33 - 4.16	8/21/2008	mg/kg	14.9	294
RT-40	C - 0.83	8/20/2008	mg/kg	< 12.9 H3	2900
RT-50	C - 0.83	8/21/2008	mg/kg	30.4	3590
RT-50	1.67 - 2.5	8/21/2008	mg/kg	32.0	1840

Notes:

Laboratory Qualifiers:

< = Not detected; value is the detection limit.

H3 = Sample was received and analyzed past holding time

All these depths are less than 5.33'
Most are less than 2' Average depth of all these samples 1.89'

Average Hexavalent Chromium content is 11mg/kg which is almost double USEPA limit for Industrial Regional Screening limit of 6.3mg/kg and 36 times the Residential Screening limit of 0.3mg/kg

This work was done in 2008, that is two years before Freeport bought back Satralloy Site and signed the COPI. Who did this sampling work? Where is lab report to support data? Was there more than one sample taken from each location?

Why do so many of these samples (9 out of 17 locations) have the H3 note applying to them that "Sample was received and analyzed past holding time" Are these even valid to use? How far past the holding time were they? The lab report should state this information

Table 4.1-1B: Slag Analytical Results - Scoping Study

Location Depth (ft)	SLG-01 0-0.5 11/8/2006	SLG-02 0-0.5 11/9/2006	SLG-03 0-0.5 11/8/2006	SLG-04 0-0.5 11/7/2006	SLG-04 0-0.5 11/7/2006	SLG-05 0-0.5 11/7/2006	SLG-06 0-0.25 11/7/2006	SLG-07 0-0.5 11/8/2006	SLG-08 0-1.0 11/8/2006	SLG-09 0-0.5 11/8/2006	SLG-10 0-0.5 11/8/2006	SLG-11 0-0.5 11/8/2006	SLG-12 0-1.0 11/8/2006	SLG-21 0-0.5 11/8/2006	SLG-22 0-0.5 11/8/2006	SLG-23 0-1.0 11/8/2006	SLG-23 0-1.0 11/8/2006
Parameter	Units																
Aluminum	mg/kg	16000 J	12100 J	12800 J	13600 J	12900 J	12400 J	13000 J	11000 J	14500 J	14300 J	11800 J	13600 J	8450 J	15700 J	7430 J	13800 J
Antimony	mg/kg	0.86 B	< 0.43	< 0.48	0.53 B	< 0.45	0.56 B	< 0.45	2.7 B	< 0.41	0.54 B	0.47 B	< 0.46	1.2 B	< 0.48	< 0.47	< 0.47
Arsenic	mg/kg	3.3	2.2	1.2 B	3.1	2.9	2.1	1.3 B	27.8	3.3	8.2	9.2	1.3 B	56.8	19.5	3.4	0.76 B
Barium	mg/kg	22.6 B	27.0	24.7 B	35.0	34.1	35.2	30.0	68.7	63.7	108	79.4	20.0 B	52.9	78.0	14.9 B	19.7 B
Beryllium	mg/kg	0.15 B	0.18 BJ	0.19 BJ	0.19 B	0.17 B	0.14 B	0.14 B	0.33 B	0.44 BJ	0.71	0.59	0.19 BJ	0.30 BJ	0.85 B	0.094 B	0.17 BJ
Cadmium	mg/kg	0.18 B	< 0.093	< 0.11	0.29 B	0.26 B	< 0.095	< 0.098	2.7	0.11 B	0.53 B	0.20 B	< 0.099	8.2	1.1 B	0.15 B	< 0.10
Calcium	mg/kg	222000 J	207000 J	232000 J	217000 J	205000 J	262000 J	256000 J	113000 J	159000 J	90000 J	98100 J	213000 J	110000 J	11300 J	115000 J	225000 J
Chloride	mg/kg	< 6.8	< 6.2	< 6.9	< 6.7	< 6.4	< 6.3	< 6.5	< 6.5	< 5.9	< 5.2	< 5.4	< 6.6	< 7.3	1410	< 6.9	< 6.7
Chromium, Total	mg/kg	1820 J	2480 J	1260 J	1900 J	1890 J	2690 J	2100 J	2890 J	1500 J	1950 J	1010 J	1810 J	2140 J	8690 J	860 J	1330 J
Cobalt	mg/kg	2.0 B	1.3 B	0.45 B	0.68 B	0.75 B	1.5 B	1.3 B	7.0 B	1.8 B	5.6 B	7.0	0.81 B	6.0 B	26.6	0.87 B	0.45 B
Copper	mg/kg	3.8	2.1 B	1.1 B	3.7	2.3 B	1.6 B	1.6 B	21.8	6.8	10.3	19.9	1.4 B	18.7	73.9	2.4 B	1.2 B
Iron	mg/kg	3130	1490	847	833	813	1190	1090	5010	3660	6310	8990	1400	2790	16400	1040	812
Lead	mg/kg	9.3	6.2	1.2	6.9	6.9	10.8	3.6	138	18.4	16.4	19.0	1.8	111	373	10.0	1.3
Magnesium	mg/kg	33600 J	28400 J	34100 J	31700 J	30100 J	33600 J	28900 J	60900 J	33800 J	35400 J	35400 J	33000 J	43100 J	179000 J	24800 J	30400 J
Manganese	mg/kg	382 J	379 J	141 J	496 J	487 J	256 J	150 J	3640 J	1180 J	2910 J	3250 J	147 J	7530 J	1680 J	297 J	107 J
Mercury	mg/kg	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011	0.013 B	< 0.011	0.15	0.010 B	0.015 B	0.025 B	< 0.011	0.097	0.89	0.015 B	< 0.012
Nickel	mg/kg	21.2	12.2 J	3.5 BJ	8.3	8.6	14.0	10.9	92.4	12.5 J	31.9	36.7	7.0 J	61.7 J	475	9.6	4.1 BJ
Potassium	mg/kg	251 BJ	149 BJ	116 BJ	95.3 BJ	92.8 BJ	118 BJ	82.9 BJ	1850 J	274 BJ	496 BJ	593 J	113 BJ	547 BJ	233 BJ	94.7 BJ	92.8 BJ
Selenium	mg/kg	< 0.38	< 0.35	< 0.39	< 0.38	< 0.36	< 0.36	< 0.37	< 0.74	< 0.34	< 0.59	< 1.5	< 0.37	< 2.1	2.3	< 0.39	< 0.38
Silicon	mg/kg	2500 J	2340 J	2730 J	3170 J	2710 J	2640 J	4200 J	3620 J	2400 J	2690 J	3170 J	2790 J	1250 J	3680 J	2360 J	1780 J
Silver	mg/kg	0.25 BJ	0.21 B	0.24 B	0.28 BJ	0.31 BJ	0.22 BJ	0.21 BJ	1.2 J	0.34 B	0.74 J	0.81 J	0.15 B	2.0	1.0 J	0.16 BJ	0.17 B
Sodium	mg/kg	< 23.0	< 21.0	< 23.6	< 22.7	< 21.8	< 21.3	< 22.1	62.6 B	< 20.1	70.6 B	48.5 B	< 22.4	< 24.7	< 52.7	< 23.3	< 22.9
Sulfate	mg/kg	3.8 B	3.2 B	3.8 B	3.5 B	2.6 B	2.7 B	5.8 B	5.4 B	3.2 B	3.6 B	12.7	7.4 B	12.5 B	2570	7.9 B	2.8 B
Thallium	mg/kg	0.99 B	< 0.61	< 0.69	< 0.66	< 0.64	0.68 B	< 0.64	1.6 B	0.82 B	< 1.0	< 1.1	< 0.65	5.0 B	4.4	< 0.68	< 0.67
Titanium	mg/kg	739	580 J	670 J	660	616	581	609	345	469 J	332	290	676 J	246 J	197	372	713 J
Vanadium	mg/kg	39.1	42.2 J	28.2 J	42.6	41.9	49.9	34.8	32.6	37.6 J	26.9	23.1	34.0 J	32.2 J	16.2 B	18.9	23.9 J
Zinc	mg/kg	70.4	27.3	8.6	61.4	64.0	38.6	21.9	878	46.9	76.4	127	13.7	966	3820	69.1	8.8
Alkalinity, Carbonate (CO3)	mg/kg	54 B	< 9.5	22 B	11 B	19 B	710	290	100 B	63 B	59 B	55 B	28000	19 B	1200	870	76 B
Phosphorus	mg/kg	31 J	15	36 J	13 BJ	17 J	7.2 BJ	4.0 BJ	44 J	44 J	56 J	89 J	24 J	64 J	25 J	54 J	93 J

Notes:

Laboratory Qualifiers:
< = Not detected; value is the detection limit.

J = Estimated value: generally where value is less than the Reporting Limit (RL) but greater than or equal to the Method Detection Limit (MDL).

B = Analyte was detected in the associated Method Blank.

All these samples depths range from zero inches to 1 foot. The average range is 0.6'. Not representative of slag that has thicknesses of over 50 feet. They are essentially scraping the surface that has been subject to weather leaching the upper layer for 35 plus years. How can they be representative if there are not also as many samples taken from depths of 2, 4, 6, 8, 10, 12, 15, 20, 25, 30, 35, 40, 45, 50, 55 & 60 feet

These samples were taken in 2006. Four years before the property was purchased by Freeport and they signed the COPI. Who did this sampling work? Where is the lab report to support these analytical results?

Table 4.1-1B: Slag Analytical Results - Scoping Study

Location Depth (ft)	Units	SLG-24	SLG-25	SLG-26	SLG-27	SLG-28	SLG-29	SLG-41	SLG-42	SLG-43
		0-0.5 11/9/2006	0-0.5 11/8/2006	0-1.0 11/8/2006	0-0.5 11/9/2006	0-0.5 11/8/2006	0-0.5 11/8/2006	0-0.5 11/7/2006	0-0.5 11/7/2006	0-0.25 11/7/2006
Parameter	Units									
Aluminum	mg/kg	13300 J	9120 J	11600 J	12400 J	15700 J	13700 J	24700 J	16900 J	14500 J
Antimony	mg/kg	< 0.45	0.74 B	0.58 B	< 0.43	< 0.42	< 0.45	< 0.55	< 0.61	2.0 B
Arsenic	mg/kg	1.5	9.5	3.2	3.2	2.0	1.2 B	1.2 B	0.77 B	< 1.0
Barium	mg/kg	30.0	39.0	62.3	48.0	25.1 B	27.8 B	31.7 B	28.4 B	33.9
Beryllium	mg/kg	0.22 BJ	0.32 B	0.46 B	0.28 BJ	0.20 BJ	0.17 B	0.16 B	0.24 B	0.15 B
Cadmium	mg/kg	< 0.097	0.70 B	< 0.092	< 0.094	< 0.092	< 0.097	< 0.12	< 0.13	< 0.11
Calcium	mg/kg	248000 J	89900 J	168000 J	210000 J	226000 J	242000 J	271000 J	221000 J	275000 J
Chloride	mg/kg	< 6.4	< 7.2	< 6.1	< 6.2	< 6.0	< 6.4	< 8.0	< 8.8	8.8 B
Chromium, Total	mg/kg	1210 J	1240 J	1070 J	1470 J	844 J	876 J	611 J	1280 J	3190 J
Cobalt	mg/kg	1.8 B	2.8 B	5.3 B	3.0 B	0.28 B	0.65 B	< 0.091	< 0.10	< 0.081
Copper	mg/kg	2.1 B	17.0	9.7	6.5	2.2 B	2.5 B	2.0 B	2.6 B	0.39 B
Iron	mg/kg	1640	3370	8150	5430	991	1530	680	149	127
Lead	mg/kg	3.0	91.1	10.0	6.5	3.6	6.1	1.6	0.72	< 0.24
Magnesium	mg/kg	27100 J	49100 J	22100 J	26800 J	26800 J	24300 J	48400 J	55300 J	39800 J
Manganese	mg/kg	181 J	844 J	616 J	276 J	223 J	285 J	141 J	213 J	206 J
Mercury	mg/kg	< 0.011	0.080	0.017 B	< 0.011	< 0.011	< 0.011	< 0.014	< 0.015	< 0.012
Nickel	mg/kg	14.0 J	29.6	15.9	10.5 J	3.9 BJ	3.7 B	1.7 B	0.87 B	1.5 B
Potassium	mg/kg	164 BJ	639 BJ	694 J	452 BJ	155 BJ	176 BJ	59.8 BJ	66.9 BJ	55.5 BJ
Selenium	mg/kg	< 0.37	0.72 B	< 0.35	< 0.35	< 0.34	< 0.37	< 0.45	0.64 B	< 0.40
Silicon	mg/kg	2000 J	2680 J	3580 J	2850 J	3050 J	2800 J	2830 J	3710 J	3170 J
Silver	mg/kg	0.20 B	0.43 BJ	0.22 BJ	0.19 B	0.24 B	0.28 BJ	0.19 BJ	0.36 BJ	0.23 BJ
Sodium	mg/kg	< 21.9	< 24.4	< 20.7	< 21.2	56.1 B	< 21.9	< 27.1	< 30.1	< 24.1
Sulfate	mg/kg	4.6 B	12.2 B	2.4 B	3.1 B	2.6 B	9.6 B	49.8	137	6.9 B
Thallium	mg/kg	< 0.64	< 0.71	< 0.60	< 0.62	< 0.60	< 0.64	< 0.79	< 0.88	0.98 B
Titanium	mg/kg	687 J	285	412	518 J	793 J	795	988	1060	704
Vanadium	mg/kg	29.9 J	15.9	27.5	29.7 J	25.5 J	34.8	35.8	85.0	83.0
Zinc	mg/kg	16.5	344	69.3	40.0	32.0	45.6	22.4	23.2	9.3
Alkalinity, Carbonate (CO3)	mg/kg	22 B	< 55	59 B	100 B	110 B	80 B	990	1200	1300
Phosphorus	mg/kg	22	68 J	130 J	50	31 J	57 J	21 J	4.7 BJ	4.0 BJ

Notes:

Laboratory Qualifiers:

< = Not detected; value is the detection limit.

J = Estimated value: generally where value is less than the Reporting Limit (RL) but greater than or equal to the Method Detection Limit (MDL).

B = Analyte was detected in the associated Method Blank.

All these samples depths range from zero inches to 1 foot. The average range is 0.5'. Not representative of slag that has thicknesses/depths of over 50 feet. They are essentially scraping the surface that has been subject to weather leaching the upper layer for 35 plus years

These samples were taken in 2006. Four years before the property was purchased by Freeport and they signed the COPI. Who did this sampling work? Where is the lab report to support these analytical results? Was only one sample collected at each location?

SHALLOW

i. = A negative instrument reading had an absolute value greater than the reporting limit.

Samples SLGBH-05 & 06 were taken from plant roads. These are not representative of the slag piles

Table 4.1-2A: Scoping Study Slag Mineralogy Results

		SLG-01	SLGDUP1	SLG-02	SLG-03	SLG-04	SLG-05	SLG-06	SLG-07	SLG-08	SLG-09	SLG-10	SLG-11
Afwillite	$\text{Ca}_3\text{Si}_2\text{O}_4(\text{OH})_6$	-	-	-	-	-	<3?	-	-	-	-	-	<5?
Amorphous	?	<35	<20	<35	<35	<35	<45	<30	<25	<25	<25	<40	>40
Aragonite	CaCO_3	10	20	10	<5	18	<3	<5	10	<3	-	-	<3
Bredigite	$\text{Ca}_{14}\text{Mg}_2(\text{SiO}_4)_8$	-	-	-	-	-	-	<3?	-	-	-	-	-
Brucite	$\text{Mg}(\text{OH})_2$	5	-	<5	5	-	7	10	<5	-	-	<5	5
Calcite	CaCO_3	42	45	35	35	40	28	30	30	40	32	10	30
Chromite	$(\text{Fe}, \text{Mg}, \text{Zn}, \text{Cu}, \text{Ni})(\text{Cr}, \text{Al}, \text{Fe})_2\text{O}_4$	-	-	-	-	-	-	-	-	<3?	-	-	<5
Cordierite	$(\text{Mg}, \text{Fe})_2\text{Al}_4\text{Si}_5\text{O}_{18}$	-	-	-	-	-	-	-	-	<3	-	-	-
Cristobalite	SiO_2	-	-	-	-	-	-	-	-	-	<5	-	-
Forsterite	Mg_2SiO_4	-	-	-	-	-	-	-	-	-	-	-	-
Gehlenite	$\text{Ca}_2\text{Al}_2\text{SiO}_7$	-	-	-	-	-	-	-	<5	13	15	20	-
Hydrotalcite	$\text{Mg}_6\text{Al}_2\text{CO}_3(\text{OH})_{16} \cdot 4\text{H}_2\text{O}$	<5	5	5	-	5	-	-	<5	<5?	-	-	<5
Lamite	Ca_2SiO_4	<5?	<5	10	<5?	-	<5	-	-	-	-	-	-
Magnesite	MgCO_3	-	-	-	-	-	5	-	-	-	-	-	-
Mica/Ilite	$(\text{K}, \text{Na}, \text{Ca})(\text{Al}, \text{Mg}, \text{Fe})_2(\text{Si}, \text{Al})_4\text{O}_{10}(\text{OH}, \text{F})_2$	-	-	-	-	-	-	-	-	-	-	-	-
Mullite	$\text{Al}_6\text{Si}_2\text{O}_{13}$	-	-	-	-	-	-	-	-	-	-	-	-
Pennine	$5\text{MgO} \cdot \text{Al}_2\text{O}_3 \cdot 3\text{SiO}_2 \cdot 4\text{H}_2\text{O}$	-	<10	-	-	-	-	-	20	-	-	-	-
Periclase	MgO	-	-	-	-	-	-	<3?	-	-	-	<3?	-
Plagioclase Feldspar	$(\text{Na}, \text{Ca})\text{Al}(\text{Si}, \text{Al})_3\text{O}_8$	-	-	-	-	-	-	<3?	-	-	-	<5	-
Portlandite	$\text{Ca}(\text{OH})_2$	-	-	-	-	-	-	-	-	-	-	-	-
Quartz	SiO_2	<3	<3	-	-	<3?	<3?	-	<5	<3?	5	<5	<3
Ringwoodite	$(\text{Mg}, \text{Fe})_2\text{SiO}_4$	<3?	-	-	-	-	-	-	-	-	-	-	-
Sapphirine	$\text{Mg}_{3.5}\text{Al}_9\text{Si}_{1.5}\text{O}_{20}$	-	-	-	<5?	-	-	-	-	-	-	-	-
Spinel	$(\text{Mg}, \text{Fe})(\text{Al}, \text{Fe})_2\text{O}_4$	-	-	-	-	-	<5?	-	-	10	10	15	<5
Unidentified	?	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Unknown 1	$\text{Ca}_4\text{Al}_2\text{O}_6\text{CO}_3 \cdot 11\text{H}_2\text{O}$	-	-	-	<10	-	<10	<10	-	-	-	-	-
Unknown 2	Ca_2SiO_4	-	-	-	<5	<5	-	20	-	<3	-	<5	<5
Unknown 3	Ca_3SiO_5	-	<5?	-	-	-	-	-	<5?	-	-	-	-
Unknown 4	$\text{K}_2\text{MgSi}_5\text{O}_{12}$	-	-	-	-	-	-	-	-	-	<5?	-	-
Unknown 5	$\text{Ca}_3\text{Al}_2\text{O}_6$	-	-	-	-	-	-	-	-	-	<5?	-	-
Unknown 6	CaAl_2O_4	-	-	-	-	-	-	-	-	-	-	-	-
Unknown 7	Al_2O_3	-	-	-	-	-	-	<3?	-	-	-	-	-
Unknown 8	$\text{C}_2\text{H}_6\text{CaO}_7$	-	-	<3?	-	-	-	-	-	-	-	-	-
Unknown 9	$\text{Ca}(\text{CrO}_2)_2$	-	-	-	-	<3?	-	-	-	-	-	-	-
Unknown 10	Cr	<3?	-	-	-	-	-	-	-	-	-	-	-
Unknown 11	(Fe, Cr)	-	-	-	-	-	-	-	-	<3?	-	-	-
Unknown 12	Fe	-	-	-	-	<1?	-	-	-	-	-	-	-
Unknown 13	(Al, Cr)	-	-	-	-	-	-	-	-	-	-	<3?	-
Unknown 14	Cr_7C_3	-	-	-	-	-	-	-	-	-	-	<3?	-
Unknown 15	$(\text{NH}_4)_2\text{FeF}_5$	-	-	-	-	-	-	-	-	-	-	-	-

Test America will help explain this table is not representative of how to do mineralogy work. They will say no competent lab would agree with what Golder Associates has put in this table. All the unknowns and amorphous can be defined.

Table 4.1-2B: Slag Boring Mineralogy Results

Mineral Name	Chemical Formula	Location Depth (ft)	SLGBH-02	SLGBH-02	SLGBH-01	SLGBH-01	SLGBH-03	SLGBH-03	SLGBH-04	SLGBH-04	SLGBH-04	SLGBH-04	SLGBH-05	SLGBH-06
			1	9	9	27	5	15.5	1	3	11	37	1	4.5
"Amorphous"	?	%	<30	<25	<20	<40	<25	<15	<10?	—	>40	<15	<15	<10?
Afwillite	Ca ₃ Si ₂ O ₄ (OH) ₈	%	—	—	—	—	7	—	60	67	—	66	—	—
Brucite	Mg(OH) ₂	%	5	—	—	7	7	—	—	8	<5	—	—	—
Calcite	CaCO ₃	%	10	—	—	7	7	—	—	—	—	—	—	—
Chlorite	(Mg,Fe,Al) ₆ (Si,Al) ₄ O ₁₀ (OH)	%	—	—	—	—	—	14	—	—	—	—	5	7
Clinoenstatite	(Mg,Fe)SiO ₃	%	—	—	<3	<3?	—	—	—	—	<3?	—	—	—
Forsterite	(Mg,Fe) ₂ SiO ₄	%	—	11	—	—	—	—	—	—	—	—	—	—
Hydrotalcite	Mg ₆ Al ₂ CO ₃ (OH) ₁₆ ·4H ₂ O	%	5	—	<5	5	—	—	5	<5	—	<5	—	—
Ilmenite	FeTiO ₃	%	—	—	—	—	—	<2?	—	—	—	—	—	—
Kaolinite	Al ₂ Si ₂ O ₅ (OH) ₄	%	—	—	—	—	—	8	—	—	—	—	6	9
Katoite	Ca ₃ Al ₂ SiO ₄ (OH) ₈	%	—	—	—	15	—	—	5	<5?	<5	<5	—	—
K-feldspar	KAlSi ₃ O ₈	%	—	—	—	—	—	—	—	—	—	—	5	5
Magnesite	(Mg,Fe)CO ₃	%	—	—	—	—	—	—	—	<3?	<3	—	—	—
Magnetite/Chromite	(Fe,Mg,Zn,Cu,Ni)(Cr,Fe,Al) ₂ O ₄	%	—	—	—	—	—	—	—	—	—	—	—	<5
Merwinite	Ca ₃ Mg(SiO ₄) ₂	%	<3?	—	7	—	<5	—	—	—	<3	—	—	—
Mica/illite	(K,Na,Ca)(Al,Mg,Fe) ₂ (Si,Al) ₄ O ₁₀ (OH,F)	%	—	—	—	—	—	—	—	—	—	—	—	20
Periclase	MgO	%	—	—	—	—	—	—	—	—	—	—	—	—
Plagioclase feldspar	(Na,Ca)Al(Si,Al) ₃ O ₈	%	—	<5	—	—	—	<5	—	—	—	—	5	8
Portlandite	Ca(OH) ₂	%	—	—	—	—	—	—	—	10	—	—	—	—
Quartz	SiO ₂	%	—	<3	<3	<3?	—	25	<3?	<3	—	—	45	36
Ringwoodite	(Mg,Fe) ₂ SiO ₄	%	—	—	<5	—	—	—	—	—	—	—	—	—
Spinel	(Mg,Fe)(Al,Fe) ₂ O ₄	%	—	—	<5	—	—	—	—	—	—	—	—	—
Steel	Fe,Cr	%	—	—	—	—	—	—	—	—	—	—	—	—
"Unidentified"	?	%	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
-----	Ca ₂ SiO ₄	%	38	25	53	20	42	—	—	—	16	—	—	—
-----	Ca ₃ SiO ₅	%	<3?	—	—	—	—	—	—	—	—	—	—	—
-----	Ca ₄ Al ₂ O ₉ CO ₃ ·11 H ₂ O	%	—	<5	—	—	5	—	—	—	—	—	—	—
-----	Cr ₃ O ₄	%	—	—	—	—	—	—	—	<2?	—	—	—	—
-----	Cr(H ₂ O)(NH ₃) ₅ Cr(CN) ₆	%	—	—	—	—	—	—	—	<2?	—	—	—	—
-----	CrSi ₂	%	—	—	—	—	—	—	—	—	—	—	—	—

Notes:

"Unidentified" accounts for that portion of the scan which could not be resolved and a "?" indicates doubt in both mineral identification and amount.

Test America will help explain this table is not representative of how to do mineralogy work. They will say no competent lab would agree with what Golder Associates has put in this table. All the unidentified and amorphous components can be defined.

Table 4.1-2A: Scoping Study Slag Mineralogy Results

	SLG-12	SLG-21	SLG-22	SLG-23	SLG-24	SLG-25	SLG-26	SLG-27	SLG-28	SLG-29	SLG-41	SLG-42	SLG-43
Afwillite	-	-	-	-	-	-	-	-	-	-	-	-	-
Amorphous	<45	<10	<20	<45	<25	<45	<20	<20	<25	<20	<40	<25	<20
Aragonite	18	-	<5	<5	<5	<5	5	10	<3	10	-	-	-
Bredigite	-	-	-	-	-	-	-	-	<5?	-	-	-	-
Brucite	<5	6	5	<5	5	-	5	<5	5	5	5	7	10
Calcite	17	<3	28	40	50	30	40	50	35	40	20	<10	30
Chromite	-	5	-	<5?	-	-	-	-	-	-	-	-	-
Cordierite	-	-	-	-	-	-	-	-	-	-	-	-	-
Cristobalite	-	-	-	-	-	-	-	-	-	-	-	-	-
Forsterite	-	46	-	-	-	-	-	-	-	-	-	-	-
Gehlenite	-	-	-	-	-	<5	5	-	-	-	-	-	-
Hydrotalcite	<5	34	5	<5	5	-	5	5	5	5	5	<5	-
Lamite	-	-	-	<5?	-	-	-	-	-	<5	<5	-	-
Magnesite	-	-	-	-	-	-	-	-	-	-	<5	-	-
Mica/Ilite	-	-	-	-	-	-	5	<5	-	-	-	-	-
Mullite	-	-	-	-	-	-	-	-	-	-	-	-	-
Pennine	<10	-	<10	-	-	<10	10	-	<10	<10	-	-	-
Periclase	-	-	-	-	-	-	-	-	-	-	-	<3	<3?
Plagioclase Feldspar	-	-	-	-	-	-	-	-	-	-	-	-	-
Portlandite	-	-	-	-	-	-	-	-	-	-	<5	-	-
Quartz	<3?	<3	<3	-	<5	5	10	5	-	<3	-	-	<3?
Ringwoodite	-	-	<3?	-	-	-	-	-	-	-	<3?	<5?	-
Sapphirine	-	-	-	-	-	-	-	-	-	-	-	-	-
Spinel	-	-	-	<5	<3?	-	-	-	-	-	<3?	<5?	-
Unidentified	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Unknown 1	-	-	-	-	-	-	-	-	-	-	-	-	<10
Unknown 2	-	-	32	<5	5	<5?	<5	5	20	10	20	50	33
Unknown 3	<5	-	-	-	-	-	-	-	-	-	-	-	-
Unknown 4	-	-	-	-	-	-	-	-	-	-	-	-	-
Unknown 5	-	-	-	-	-	-	-	<5?	<3?	-	-	-	-
Unknown 6	-	-	-	-	-	-	-	-	-	-	-	-	-
Unknown 7	-	-	-	-	-	-	-	-	-	-	-	-	-
Unknown 8	-	-	-	-	-	-	-	-	-	-	-	-	-
Unknown 9	-	-	-	-	-	-	-	-	-	-	-	-	-
Unknown 10	-	-	-	-	-	-	-	-	-	-	-	-	-
Unknown 11	-	-	-	-	-	-	-	-	-	-	-	-	-
Unknown 12	-	-	-	-	<3?	-	-	-	-	-	-	-	-
Unknown 13	-	-	-	-	-	-	-	-	-	-	-	-	-
Unknown 14	-	-	-	-	-	-	-	-	-	-	-	-	-
Unknown 15	-	-	-	-	<3?	-	-	-	-	-	-	-	-

Test America will help explain this table is not representative of how to do mineralogy work. They will say no competent lab would agree with what Golder Associates has put in this table. All the unknowns and amorphous can be defined.

Table 4.2-1: Dust Analytical Results

		Sample ID Date	Dust (Bags)							Dust (Roof)					
			NMB1-T1 10/24/2014	NMB2-T1 10/24/2014	NMB2-T1-DUP 10/24/2014	NMB3-T1 10/24/2014	SMB1-T1 10/24/2014	SMB1-T1-DUP 10/24/2014	SMB2-T1 10/24/2014	SMB3-T1 10/24/2014	CWPH-ROOF 5/2/2014	NMB ROOF-DUP 5/2/2014	NMB-ROOF 5/2/2014	SMB-ROOF 5/2/2014	WWTP-ROOF 5/2/2014
Parameter	Unit														
Aluminum	mg/kg		8700	11000	10000	8400	9900	9500	9800	5300	12000	11000	11000	12000	12000
Antimony	mg/kg		0.61 J	0.80 J	0.62 J	0.85 J	1.1 J	1.1 J	3.6 J	< 14	0.83 J	< 1.9	< 1.9	2.2	< 2.1
Arsenic	mg/kg		7.1 J	< 31	< 30	30	21	21	63	64	95	22	23	220	36
Barium	mg/kg		44	47	42	65	71	74	110	46	170	64	63	340	190
Beryllium	mg/kg		0.28 J	0.22 J	0.22 J	0.42 J	0.42 J	0.46 J	0.48 J	0.26 J	0.70	0.19 J	0.20 J	0.89	1.5
Cadmium	mg/kg		1.3	1.5	1.4	2.3	1.6	1.9	4.7	2.3 J	3.7	1.0	1.0	6.3	2.6
Calcium	mg/kg		92000	130000	120000	58000	48000	39000	53000	18000	70000	100000	100000	34000	36000
Chromium, Hexavalent	mg/kg		389	1010	905	817	25.6	17.5	0.394	54.8	5.02	11.2	60.5	2.01	0.408
Chromium, SPLP Total	mg/L		13 B	23 B	25 B	31 B	0.78 B	0.73 B	0.077 B	1.0 B	0.27	0.29	0.42	0.13	0.048
Chromium, Total	mg/kg		8200	32000	27000	4700	1400	1300	1100	2000	1400	2700	2800	910	730
Cobalt	mg/kg		13	29	24	17	11	11	20	16	24	12	12	68	12
Copper	mg/kg		62	62	42	50	430	58	160	140	75	28	32	100	1100
Iron	mg/kg		29000	25000	29000	26000	30000	26000	81000	79000	21000	11000	11000	25000	17000
Lead	mg/kg		140	99	92	360	140	160	210	250	78	45	39	92	270
Magnesium	mg/kg		40000 B	53000 B	50000 B	83000 B	32000 B	31000 B	32000 B	42000 B	21000	26000	27000	17000	14000
Manganese	mg/kg		580	680	550	1500	2600	2800	9300	8900	20000	3600	3500	65000	8500
Nickel	mg/kg		240	390	350	430	210	150	210	310	200	220	230	280	110
Potassium	mg/kg		1100 B	1200 B	1100 B	7100 B	2300 B	2300 B	1900 B	2100 B	1200 B	580 B	590 B	2100 B	1000 B
Selenium	mg/kg		< 2.0	< 2.1	< 2.0	1.5 J	< 3.6	< 4.0	< 21	3.9 J	< 40	< 7.8	< 7.6	< 180	< 21
Silver	mg/kg		0.34 J	0.32 J	< 1.0	0.43 J	0.44 J	0.43 J	1.1	1.1 J	1.7	0.39 J	0.40 J	5.4	0.68 J
Sodium	mg/kg		990	810	750	2000	510	500 J	700	370 J	330 J	180 J	190 J	400 J	230 J
Thallium	mg/kg		2.7	9.5	7.9	3.0	1.8 J	2.0 J	5.1 J	6.5 J	< 40	< 7.8	< 7.6	< 180	< 21
Vanadium	mg/kg		110	75	64	26	130	110	32	21	38 B	44 B	45 B	62 B	22 B
Zinc	mg/kg		510 B	680 B	580 B	2300 B	840 B	780 B	1600 B	810 B	590	330	330	740	1200
Corrosivity	Std Units		10.2	12.3	12.3	10.8	8.95	9.06	8.65	8.65	8.51	8.57	8.56	8.40	7.85
pH	Std Units		10.2	12.3	12.3	10.8	8.95	9.06	8.65	8.65	8.51	8.57	8.56	8.40	7.85

Notes:

All Samples are composites

DUP = Field duplicate

-- = Not analyzed

Laboratory Qualifiers:

< = Not detected; value is the reporting limit.

J = Estimated value: generally where value is less than the Reporting Limit (RL) but greater than or equal to the Method Detection Limit (MDL).

Everyone of these Hexavalent Chromium lab results reported by Golder Associates exceeds USEPA limits for Residential Regional Screening limits yet the RI/FSforFSS is silent about this fact.

How can so much important yet negative information for Feeport McMoRan be just ignored in the narrative and in the Conceptual Site Models and Ecological Risk Asssesments?

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Appendix L

Treatability Studies

Treatability Study Work Plan

If the need for treatability studies arises during the conduct of the RI/FS, Respondent shall submit for review and approval a Treatability Study Work Plan prepared in a manner consistent with U.S. EPA's *Guidance for Conducting Treatability Studies Under CERCLA*, EPA/540/R-92/071a, October, 1992 (Treatability Study Guidance). The Treatability Study Work Plan may incorporate by reference approved portions of the RI/FS Work Plan and supporting documents.

I. Data Quality Objectives (Section 3.2 of the Treatability Study Guidance)

Respondent shall establish DQOs for the treatability study and incorporate them into the Treatability Study Work Plan, the study design, the FSP, and the QAPP.

II. The Treatability Study Work Plan shall address the following elements:

A. Project Description

Respondent shall provide background information on the Site and summarize existing waste characterization data (matrix type and characteristics and the concentrations and distribution of the contaminants of concern). Respondent shall also specify the type of study to be conducted, *i.e.*, remedy screening; remedy selection testing; or remedy implementation.

B. Treatment Technology Description

Respondent shall briefly describe the treatment technology to be tested. Respondent may include a flow diagram showing the input stream, the output stream, and any side-streams generated as a result of the treatment process. Respondent shall also include a description of the pre- and post treatment requirements.

C. Test Objectives

Respondent shall define the objectives of the treatability study and the intended use of the data (*i.e.*, to determine potential feasibility; to develop

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performance or cost data for remedy selection; or to provide detailed design, cost and performance data for implementation. Respondent shall include performance goals that are based on established cleanup criteria for the Site or, where such criteria do not exist, on contaminant levels that are protective of human health and the environment.

D. Experimental Design and Procedures

For any experimental design, Respondent shall identify the tier and the scale of the testing, the volume of waste material to be tested, the critical parameters, and the type and amount of replication. For the design of the experiment, Respondent must consider the DQOs and the costs associated with replication. Respondent shall describe the specific steps involved in the performance of the treatability study in the standard operating procedures (SOPs). The SOPs should be sufficiently detailed to allow the laboratory or field technician conducting the test to operate the equipment and to collect the samples.

E. Equipment and Materials

Respondent shall list the equipment, materials, and reagents that will be used in the performance of the treatability study, including quantity, volume/capacity, calibration or scale, equipment manufacturer and model numbers, and reagent grades and concentrations.

F. FSP and QAPP

Respondent shall describe how the existing FSP (Section 2.2 and Appendix B of this SOW) and QAPP (Section 2.3 and Appendix C of this SOW) shall be modified or amended to address field sampling, waste characterization, and sampling and analysis activities in support of the treatability study. Respondent shall describe the kinds of samples that will be collected and specify the level of QA/QC required.

G. Data Management

Respondent shall describe the procedures for recording observations and raw data in the field or laboratory. If proprietary processes are involved, Respondent shall describe how confidential information will be handled.

H. Data Analysis and Interpretation

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Respondent shall describe the procedures for analyzing and interpreting data from the treatability study, including methods of data presentation and statistical evaluation.

I. Health and Safety Plan (HASP)

Respondent shall describe how the existing HASP (Section 2.4 and Appendix D of this SOW) shall be modified or amended to address the hazards associated with treatability testing.

J. Residuals Management

Respondent shall describe the management of treatability study residuals. Respondent should include estimates of both the types and quantities of residuals expected to be generated during treatability testing based on the treatment technology and the experimental design. Respondent shall also outline how treatability study residuals will be analyzed to determine if they are hazardous wastes and discuss how such wastes will be managed.

K. Reports

Respondent shall describe the preparation of interim and final reports documenting the results of the treatability study. For treatability studies involving more than one tier of testing, Respondent shall provide interim reports, which provide a means of determining whether to proceed to the next tier. Respondent shall also describe how the existing monthly progress reports (Section 11 of this SOW) shall be modified or amended to include reporting of treatability study progress.

L. Schedule

Respondent shall include a comprehensive treatability study project schedule indicating critical path dependencies and including dates for the initiation, duration, and completion of each treatability study task. The schedule shall also include field work and development and submittal of required deliverables. To the extent that the performance of the treatability study will impact the RI/FS project schedule (Section 2 of this SOW), Respondent shall submit a revised RI/FS project schedule for review and approval concurrent with the Treatability Study Work Plan.

III. Treatability Study Report Format (Section 3.12 of the Treatability Study Guidance)

Contents

Upon completion of the treatability study(ies), Respondent shall submit for review and approval a Treatability Study Report. The report shall be organized as follows:

- A. Introduction
 - 1. Site Description
 - a. Site Name and Location
 - b. History of Operations
 - c. Prior Removal and Remediation Activities
 - 2. Waste Stream Description
 - a. Waste Matrices
 - b. Pollutants/Chemicals
 - 3. Treatment Technology Description
 - a. Treatment Process and Scale
 - b. Operating Features
 - c. Treatment Residuals Management
 - 4. Previous Treatability Studies at the Site
- B. Conclusions and Recommendations
 - 1. Conclusions
 - 2. Recommendations
- C. Treatability Study Approach
 - 1. Test Objectives and Rationale
 - 2. Experimental Design and Procedures
 - 3. Equipment and Materials
 - 4. Sampling and Analysis

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- a. Waste stream
 - b. Treatment Process
- 5. Data Management
- 6. Deviations from the Work Plan
- D. Results and Discussion
 - 1. Data Analysis and Interpretation
 - a. Analysis of Waste Stream Characteristics
 - b. Analysis of Treatability Study Data
 - c. Comparison to Test Objectives
 - 2. Quality Assurance/Quality Control
 - 3. Costs/Schedule for Performing the Treatability Study
 - 4. Key contacts

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References

Appendices

- A. Data Summaries
- B. Standard Operating Procedures