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September 19, 2019

Shannon Cook
Site Coordinator, Division of Environmental Response and Revitalization
Ohio Environmental Protection Agency
Southeast District Office
2195 Front Street
Logan, Ohio 43138

Re: ***Former Satralloy Site—Response to Anonymous Letters***

Dear Mr. Cook:

By this letter Cyprus Amax Minerals Company (CAMC) provides the Ohio Environmental Protection Agency (OEPA) responses to two letters sent to OEPA (October 3, 2018 to Maria Galanti and February 4, 2019 to Kristy Hunt) by an anonymous author calling himself/herself "Friends of Kolmont" (herein referred to as FOK).

CAMC responded to five previous letters from FOK dated between July and September 2018 (letter to Maria Galanti dated January 10, 2019). To a significant extent, the two more recent letters overlap or even repeat previous comments.

In these two letters and the previous letters, FOK repeatedly claims bias by Golder and the others who prepared the Remedial Investigation (RI) and associated risk assessments for the Former Satralloy Site (the Site). While the background and experience of FOK and the author of the FOK letters is unverified, the qualifications and experience of CAMC's experts are public and substantial. These men and women have built their careers with decades of training, detailed work, and professional interaction with governmental agencies in their fields of expertise. These qualifications and experience were summarized on Attachment A to CAMC's prior response letter.

Attachment A to this letter provides a review of FOK's principal questions or claims and CAMC's detailed responses. Of course, OEPA already is aware of most of the information in this attachment. CAMC is providing its responses so that FOK's accusations do not stand unanswered in the public record.

CAMC's responses are founded on its experts' knowledge and the extensive data collected and work performed by them for over a decade at the Site under OEPA's

approved workplans and oversight. Please let us know if OEPA has questions or wants additional detail.

Sincerely,

Todd Weaver

ATTACHMENT A

DETAILED COMMENT RESPONSES

This document provides responses to comments raised in two letters sent to OEPA (October 3, 2018 to Maria Galanti and February 4, 2019 to Kristy Hunt) by an anonymous author calling himself/herself "Friends of Kolmont" (herein referred to as FOK) The comments in the letters are repetitive and not organized by topic To respond, we have either quoted or summarized the comment(s) (grouping similar comments together) Typographical errors in the FOK letters were retained in the quotes from those letters used below The order of response below generally follows the order of comments in the given letter

October 2018 FOK Letter

Comment 1

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?

Response This comment repeats comments in the prior FOK letters In CAMC's previous response letter, dated January 10, 2019, CAMC addressed FOK's allegations of "inconsistencies" in the ferrochromium slag conclusions

Comment 2

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!!!

Response

The 2008 mineralogy study was performed well before the RI Workplan was approved, and had the limited objectives clearly defined in Section 3 3 2 The data collected also provided insight into geochemical properties and the potential fate of contaminants associated with the slag piles that was useful in planning RI activities The environmental analyses for the mineralogy study were performed by the same laboratory (TestAmerica) as was used for the remainder of the RI

Neither CAMC nor OEPA ignored "negative" laboratory results FOK misunderstands how USEPA screening levels are used in a remediation of this type USEPA developed these levels for initial screening of results to focus subsequent investigations CAMC conducted site-specific risk assessments for this Site, and these risk assessments provide the appropriate basis for determining the need for and extent of remediation Thus, at the former Satralloy Site, where site-specific risk assessments have been performed as part of the RI, the screening levels have served their limited screening purpose and it is not necessary to further compare site data to the screening levels

Comment 3

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?

Response

Slag data in the RI were collected during three separate investigations, each with a different purpose, as clearly described in the draft RI report As described in RI Section 3 3 4, slag sampling completed in 2014 included subsurface slag samples "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) 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 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 " (emphasis added) Sixteen (16) samples were collected for analysis, 75% of which were collected more than 5 feet below surface Prior sampling results were consulted to select RI slag boring locations with a full range of total chromium concentrations (high and low) and locations where thick layers of slag were previously documented Slag from both surface and subsurface samples representing the full range of chromium concentrations and the full range of slag depths were analyzed for hexavalent chromium

In addition, a point ignored by FOK is that both "soil" and "slag" were sampled during the RI, and the dividing line between "soil" and "slag" is not distinct As stated in RI Section 4 5,

> Site soils have been extensively reworked during development and industrial operations In the lowlands and in many Site roads (lowlands and uplands), it is apparent that slag was used as fill As a result, in the lowlands there is a highly variable mixture of native soil, clean fill, and slag fill In the uplands there are also slag/soil mixtures, but much less extensive than in the lowlands Samples taken for slag characterization (Section 4 1) were 100% slag Samples (both surface and subsurface) taken for characterization of Site soils (discussed in this section) consisted of soil with a variable percentage of slag (up to 100% slag) Some of the locations for soil sampling had surface slag deposits, and these were included in the surface "soil" samples Given that a key purpose of the soil sampling was to represent potential exposure point concentrations (EPCs) to human and ecological receptors, it is not necessary to separate pure slag from soil and soil/slag mixtures in

discussing soil results In addition, as the samples included a continuum between pure slag and native soil, division between "soil" and "slag" would be somewhat arbitrary

What is most important is to sample the full range of Site conditions and exposure point concentrations (EPCs) As a result, while the FOK comments incorrectly advocate emphasis on worst-case concentrations and conditions, the RI presents data representative of the full range of Site concentrations and conditions including but not limited to worst-case data

Comment 4

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?

Response

The comment refers to data collected during the "Scoping Study," prior to the main RI effort The Scoping Study was used to inform the planning of the main RI, and demonstrates the proactive approach CAMC has used at this Site This initial study allowed CAMC to develop, with OhioEPA's approval, a reliable approach to the representative collection of subsequent slag samples that were analyzed for hexavalent chromium

See response to Comment 2 regarding screening levels

Comment 5

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/FSforFSS 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 RIIFS 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?

Response

SLGBH-01 was not drilled beneath a current or former rail spur The boring was drilled approximately 110 feet south/southeast of the original rail spur, and 90 feet south/southeast of the new rail spur This location is representative of slag in the northern lowland area See also response to previous comment

ATTACHMENT A

DETAILED COMMENT RESPONSES

Comment 6

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?

Response

These locations were selected to determine the chemical composition of materials beneath the roadbed As discussed in the response to Comment 3, the sampling program was designed to represent the full range of Site conditions, including "soil" as well as "slag " No previous samples had been collected beneath the road leading to the uplands Visual observations suggested that the roadbed may be underlain by ferrochromium ore

Comment 7

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 1-1 A 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 Satralloy 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

Response

Please see the response to comments 2 through 6 for a discussion of CAMC's sampling plan and the use of screening results

Comment 8

How can presence of so much Hexavalent Chromium not be a significant potential health problem at the Satralloy Site?

Response

The Human Health Risk Assessment (HHRA), Appendix A of the draft RI report, provides a robust and detailed analysis of the potential health effects from the slag The HHRA indicates that a portion of the slag has hexavalent chromium concentrations that could pose a carcinogenic risk above OEPA's acceptable levels The majority of the slag, however, has potential carcinogenic risk below this level and poses relatively low risk

Comment 9

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

Response

FOK comments (above comment and elsewhere) can be grouped into two general comments

1 FOK questions the lack of discrete chromium-bearing minerals identified in the mineralogical analysis

2 FOK expresses concern about the amorphous material identified

Slag is a by-product of the recovery of chromium from ore As such, the slag contains generally low levels of chromium (< 1%), as demonstrated by the laboratory analytical results for the slag samples In contrast, the tool used for mineralogical analysis, X-ray diffraction (XRD), has detection limits in excess of 1%, as can be seen in Tables 4 1-2A and B, with detection limits ranging from 3 to 5% for a number of minerals The variation in these detection limits is due to the fact that the limits depend on the crystallinity of the mineral in question, with lower detection limits for minerals that are more crystalline in nature Based on process knowledge, one would not expect the presence of discrete chromium-bearing minerals in slag in quantities that can be detected by XRD During the chromium recovery process, the chromium-bearing ore minerals are destroyed, and the remaining chromium typically reports to the amorphous (glassy) phase present in slag

Amorphous, or glassy, material is a common component of slag It is a high-temperature product, with the rapid cooling of the liquid slag resulting in the development of glassy materials Because of the absence of crystalline structure in the amorphous material, XRD cannot assign a mineral name, and identifies it as "amorphous" Further mineralogical delineation of the amorphous phase is not relevant The slag's total chromium content and leachability, as well as site-specific information related to surface water and groundwater quality, are used to determine the potential environmental stability of the slag Detailed

information on the mineralogical composition of the slag may serve to better understand its leaching behavior, but it is not essential for evaluating potential environmental effects

Comment 10

In Table 4 1-1 A, 9 out of the 17 samples shown have a foot note that the "Sample was received and analyzed past holding time"

Response

The samples referenced by Comment 10 were initial samples Subsequent RI samples were not held beyond their holding time and provided analytical results that superseded the initial samples referred to above

Comment 11

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 minerology to calibrate their XRF equipment? If this XRF work is based on a minerology 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 minerology work why was this information not reported in the RI/FSforFSS?

Response

Field screening was used to select a representative range of sample for analysis The comment demonstrates a lack of understanding of field screening All field XRF use was conducted in accordance with EPA Method 6200, *Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment* The XRF was properly calibrated using standard accepted procedures The data used for the RI evaluations were the laboratory analyses of these samples, meaning that CAMC did not solely rely on XRF data

The statement that amorphous minerology somehow invalidates XRF data is completely erroneous (see also response to Comment 9)

Comment 12

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 5-1 B - 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 USE PA Regional Screening Limits Does the OhioEPA feel like there is a pattern of selective analysis work being done by Golder Associates and Freeport McMoRan?

Response

See responses to previous comments CAMC would refer FOK to the draft RI report, which describes the specific purposes of the various sampling and analytical efforts The RI was designed to provide sufficient data for evaluation of potential risks to human health and the environment, and for future use in the

Feasibility Study (FS) for the evaluation of remediation alternatives As is normal for any well-designed investigation, not all samples are analyzed for all possible parameters

Comment 13

In looking at this preliminary [Treatability Study] 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?

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

Response

Cronimet provided CAMC with a final report on the data from its Treatability Study The FS will objectively evaluate the Treatability Study results in developing remediation alternatives for the Site

Comment 14 (bullet list) and Response

FOK had a bullet list of comments on the Treatability Study The FS will consider the results of the Treatability Study and objectively evaluate remedial alternatives for the Site

Comments on RI Tables

These comments are all addressed in the responses above

Comments on Appendix L

These comments are all addressed in the responses above

Responses to February 2019 FOK Letter

All comments in this letter are addressed above and/or were addressed in the previous CAMC response letter