

Technical Working Group – Trace Element TWG

Pebble Project

November 20, 2008

Atwood Building Room 1270

Minutes Recorded by Charlotte MacCay/Pebble Partnership (PLP)

I. PRESENT:

Jeff Estensen (ADF&G), lead
Andrea Meyer (ADNR)
Pete McGee (ADEC)
Bob Seal (USGS)
Bronwen Wang (USGS)
Mari Reeves (USFWS)
Vallane Glooschenko (USACE)
John Pavitt (EPA)
Francis Mann (USFWS)
Charlotte MacCay (PLP)
Mark Stelljes (SLR)

Public

Kendra Zamzow (CSP2)

ADMINISTRATIVE

- Jeff Estensen was nominated and seconded to serve as lead for the Trace Element TWG.
- (Agency) The lead decides the agenda for the meeting. The agenda will be prepared and distributed one week in advance of the meeting.
- TWG Guidelines and Protocols were briefly reviewed since this was the group’s first TWG meeting.

CHARACTERIZATION/MONITORING

(PLP) PLP would like to clarify the types of data it is collecting to better facilitate future discussions. The data collected to date have been collected for site characterization. The data are meant to be used to write the Affected Environment Section of the NEPA (EIS) document. Because NEPA calls this “baseline information” PLP has also been referring to this data as baseline data. This has led to some confusion. PLP is trying to avoid any further use of the word ‘baseline’ to minimize confusion. To scientists, baseline means something quantifiable that can be used for comparison with data collected during operations to see if there have been any impacts. That was not the intent of the data we have collected to date. Although PLP hopes that some of these data will be useful for monitoring purposes as well. PLP is finishing up the characterization data and moving into monitoring data, which will be used for comparison purposes

with data collected after operations begin, but this term is causing confusion as well. Some people interpret monitoring data to be the data collected during operations.

(PLP) This is a new change in the use of the terms, and the clarification of use of terms needs to be incorporated by the consultants in the future as well. There are some times when PLP and the consultant are hoping that the characterization data may be useful for monitoring as well and we need to be clearer in stating those objectives.

(Agency) What is the potential time frame to allow for preterm-monitoring?

(SLR) When you have a known project then you can start looking at preterm- monitoring. Should be within the next couple years.

(PLP) Some preterm monitoring can be initiated now. The general area of the deposit is known, so we have set some stations in logical areas and we can refine the stations over time as the project design is developed. Some stations will be eliminated over time, others added, but quite a few should be able to remain the same. It is hoped to start permitting in late 2009 to early 2010, but regardless of when permitting starts, the permitting process is likely to take several years before permits are finalized and construction can begin. This allows several years for preterm monitoring to add to what data have already been collected.

NON-BINDING INPUT

(PLP) PLP would also like to clarify that we are asking for speculative input at this time. We are aware that you do not have the data from the studies done to date to learn how they are working. We fully expect that as the data become available, and the agencies complete their review, that the agencies may have new input or want to change their mind about previous recommendations. There is nothing binding about any of the recommendations you make during the TWG meetings, you can always refine your input based on data as they become available. PLP is just trying to establish open dialogue and set studies up as best as possible.

STUDY PLANS

(PLP) In response to the comments from the agencies that study plans were not available for review until too late in the season, PLP has scheduled its budget review process earlier in the year allowing consultants opportunity to develop their study plans earlier. We expect study plans to be ready sometime in January. At the Steering Committee it was discussed that the agencies should have one month to review the study plans prior to having a TWG meeting to discuss them. It would be helpful if the agencies put their requests for changes to the study plans in writing along with their rationale for the change. PLP will respond in writing to comments on the study plans within approximately 2 weeks of the TWG meeting explaining which revisions are being incorporated, and where revisions are not incorporated, the reason why that suggestion was not incorporated. There can be further discussion on the study plans and proposed revisions at subsequent TWG meetings.

(Agency) Some of the agencies wanted 2 months to review the study plans, but the Steering Committee decided that the TWGs should provide feedback within one month.

(PLP) TWG members can continue to comment all through the season as you continue to review the study plan; sometimes changes can take place later in the season.

INFORMATION AVAILABLE

(PLP) Pebble Project Study Plans and Field sampling Plans are available on the web site.

(Agency) PLP has also made a release to the public of the Trace Element raw data through 2007.

(PLP) If the TWG would like to review Mark's Annual Agency Environmental Presentation power point at a slower pace, that might be helpful.

TARGET SPECIES FOR TRACE ELEMENT STUDIES

(Agency) The closest thing to these studies is the Red Dog Risk Assessment, which was a lot of effort – has this been considered? Does it include concerns such as impacts to voles and ptarmigan?

(Agency) Is the objective of these studies characterization or baseline?

(SLR) The studies were being done to characterize the site, with the goal that much of the data may be able to be used for preterm monitoring data as well.

(Agency) Why fish and no other animal targets?

(SLR) We have not had mammalian data to date, but it will be included in the 2009 study plans. The Study Plans will address bear and caribou, tissue, hair, blood and plasma, but we are not doing small mammals. We are focusing on high trophic level species and subsistence species.

(Agency) At Red Dog they focused on the risk to voles and ptarmigan not on the large mammals, which were also included in some North Slope Studies.

(Agency) Large mammals integrate impacts from other areas and may not be indicative of site impacts. Burrowing residents are indicative of that site only and not areas outside of the area of interest.

(SLR) We will likely take plant and soil data and model uptake for small mammals. We may go back and consider small mammals once there is a project design. Transects could be set up and the study should not need to take more than a few days, somewhat dependent on the success rate for trapping.

(Agency) Are these non-lethal studies for the large mammals?

(SLR) The large mammals would be anesthetized, and then sampled. It will be non-lethal. Small mammal studies would need to be lethal.

(Agency) Why aren't invertebrates sampled?

(SLR) Because we are sampling pretty much all of the plant species we should be able to model uptake.

SOIL SAMPLING

(Agency) Data gaps exist for organic carbon in soils, acid volatile sulfides (AVS) and simultaneously extractable metals (SEM). **(Agency comment provided during review of the minutes) the data gap is in the sediments.**

(Agency) The SEM-AVS methodology indicates that there is a safe amount of metals in the sediments if the molar ratio of your metals to acid volatile sulfur is less than one ($SEM:AVS < 1$). A ratio of $SEM:AVS > 1$ does not mean your sediments are toxic, it does mean there are some available metals that need to be assessed to determine if there is potential for impact in a risk assessment.

(Agency) When the project gets to looking at potential impacts the TWG needs to discuss the merits of a PEC approach vs. SEM:AVS approach for things like a hypothetical copper concentrate spill.

(Agency) are you looking at total metals?

(SLR) Yes, we only did AVS/SEM for a small set of subsamples. There were not enough samples to get a correlation area-wide. Everything we saw had $SEM:AVS < 1$.

(Agency) This needs to be investigated to see if there is a data gap here.

(Agency) USGS can identify published literature on the topic if anyone is interested.

(SLR) Progress so far:

- 2004 Grid samples were collected, random samples in a subset of the grid regardless of geology and habitat.
- 2005 The study was modified so that sample locations were proportional to habitat abundance and co-located for plants and soils. There was an extra event for early season/late season to see if changes in concentration occur over the seasons. Aquatic plants, ponds, and seeps were added to the study plan.

Sampling stations changed some in 2005 kept some/added some. Added the Pebble East area.

In 2005 we stopped sampling the subsurface soils.

Aquatic sampling was extended to include three different types of ponds. The ponds are formed differently and likely had different sediments.

Sampling included the proposed road alignment

(Agency) Were invertebrates sampled, they can be important to shorebirds?

(SLR) We have not seen any shorebirds in the ponds, and didn't see pond sediment invertebrates as a critical part of characterization.

(Agency) What about fish in tributaries, their critical food is often aquatic invertebrates.

(SLR) Only 2 out of 14 – 16 ponds had outlets all the rest were isolated, they did not contain fish.

(Agency) Aquatic invertebrate data could also be helpful to evaluate the quality of the foodweb. Maybe a group of ponds is better habitat for invertebrates and there would be more there to observe.

(SLR) Are you interested in composition or tissue levels?

(Agency) Are there any guidelines for concentrations in food sources for fish. You might get a bunch of numbers but not be able to do anything with it. It's more important to know if invertebrates are there and their composition.

(SLR) There's not much data for meaningful use of metals concentrations in invertebrates.

(Agency) It is more of a preterm monitoring baseline issue.

(Agency) How do you determine between the types of ponds?

(SLR)

- Ponds that dry up and have no connectivity, likely to be of least relevance
- Groundwater fed ponds, tend to have aquatic vegetation along the edges – could have connectivity
- Beaver ponds

(Agency) I wouldn't argue a priori that groundwater fed ponds are better habitat, you need a comparison of ecological value first before deciding which ponds are most important to sample.

(Agency) What drives what's essential? What's needed for NEPA – there is no cookbook.

(Agency lead) Possibly we could write up a list.

(SLR)

- In 2006 we switched focus to Pebble East and a few sites that were only sampled in 2005 for which we wanted a second year of data.
- For every location we aimed for four data points: one from July and August over two years for every location. We realize there is no cookbook for data sufficiency. We are looking at power curves and variability for the data sets. In the Environmental Baseline Document we will look at the coefficient of variation for every element in every medium to determine the number of samples needed to reach X power. Then we can ask if the power we obtained is sufficient.

(Agency) Soil samples around the deposit may be inadequate. Usually there is a hydrothermal halo around this type of deposit. You may need more samples to characterize the halo's imprint on background geology. The present sampling design may not be capturing those potentially higher values. Discuss with the geologists and exploration crew. It's important at closure to know what the halo soils were.

(SLR) We have a surficial geology map now that we can consult and review the adequacy of the sample distribution.

(Agency) Are you doing any grain size analysis?

(SLR) No. We would do that with organic carbon. **(Agency comment provided during review of the minutes) These comments seem out of place or at least out of context. I think I was the agency person and we were discussing sediments, not soils, at the time.**

(Agency) If we make any procedural modification we could note how it changes results in relation to the permanence of the location.

(SLR) Out of 251 soil samples only about eight are in the pit area.

(SLR) We are not collecting soil samples at depth. We saw equal or lower levels of trace elements with depth. The tundra mat [with shallow root systems] is the biologically active zone so we focused on the top six inches of soil. We pull the tundra mat back, and take soil from the top six inches. We get some roots mixed in, but we do our best to try and keep the roots separate.

(SLR) There is a high concentration of petroleum range hydrocarbons in the soils. This happens in Alaska from biogenic sources in shallow soils.

(SLR) Soils can exceed state target levels with natural sources of petroleum hydrocarbons.

(Agency) You may want to ask for a silica gel clean-up before analyses.

(SLR) The lab says that gets rid of too much of the hydrocarbons you want to analyze for. There are problems with getting reproducible results.

(Agency) If you use the idea that DRO is already there then it would be good to have the constituents.

(SLR) Constituents are not the same everywhere in the study area. We would be fingerprinting up to 100s of samples. There may be value in doing aromatic and aliphatic composition analysis for a subset of samples. That could have value without getting into separate analyses. We have also archived some samples.

(SLR) The presence of biogenic material is ubiquitous in Alaska, but I haven't seen it this high in any other projects I have worked on. The material is compressed humic material. Ash in the soils represents colloidal aluminum hydroxides and silicates which hold on to humic material. We also see a trend of lower RRO in outwash plains.

(SLR) Key soil findings

- Half of the metals analyzed for were highest on talus slopes
- The other half were highest in the moraines

There is naturally occurring cyanide. Volcanic ash is one potential source **(Agency comment provided during review of the minutes) I don't think this was said. I think the comment was that volcanic ash layers may inhibit the natural degradation of cyanide – NOT that ash was a source.** but it may be from cyanogenic bacteria, there is some qualitative support to the latter theory. One cyanogenic bacteria genus is present in the area according to literature – it has not been field-truthed. Cyanide is also found in the plants, but we don't think the plant species themselves are cyanogenic.

(Agency) Is there any seasonality. Cyanide photodegrades at surface.

(SLR) The cyanide is trapped beneath the tundra mat and may be coming from groundwater hitting tundra mat and being trapped.

(PLP) Water samples may show some seasonality for cyanide. It seems to be higher sometimes after the late heavy summer rains. The rains could be flushing what builds up in the system during the summer season when the bacteria would be present.

(Agency) Look for a correlation with soil pH.

(Agency) pH strongly affects the release of metals.

(Agency) Why is pH not being collected?

(SLR) The majority of rock extracts did not seem far from neutral at any site. It was an assumption that pH in that range would not affect movement in soils.

(Agency) Are there any archived samples?

(SLR) Unsure how long the lab archives these samples. We may be going back to each site next summer – we could collect pH at each site on the return sampling. The time period should not be a factor leading to any difference in pH at the different sampling dates since this is a natural system.

(Agency) What are “high “ levels for trace element concentrations at the site?

(SLR) Arsenic has a 74 ppm maximum value and average of 10 ppm. Copper is 27.4 ppm average, 197 ppm maximum – this is an order of magnitude lower than the human health impact level.

(Agency) EPA cancer endpoint is well below background across the State for arsenic. The lead endpoint is 400 mg/kg and copper endpoint is 1000 mg/kg.

(SLR) Mercury is lower in river sediments, Copper is also lower in river sediments.

(Agency) We suggest that you look at median values instead of mean values.

(SLR) All our tables show both median and arithmetic mean values.

(SLR) The last step will be to determine significant differences and to do the GIS overlay by elements for soils, plants etc...

(SLR) TWG input is desired to determine which naturally occurring constituents are of interest to be put on the GIS overlay. All constituents will be too busy of an overlay. Most interest for this type of deposit, and human and ecological toxicity concerns, are Cu, Mo, As, Cd, Ni, Pb, Zn, Hg, Sb, and Fe.

(Agency) Antimony may be more toxic than arsenic and more mobile so it is of interest. Mercury is an interest because there is a general public concern about mercury.

(Agency) Cyanide.

(SLR) Cyanide seems lowest in seeps so it doesn't appear to be coming from subsurface, seems generated in the shallow soils. Cyanide is found more in minor drainages. It is somewhat higher in the South Fork and Upper Talarik than the North Fork.

(Agency) What is barium like?

(SLR) It's not particularly higher at certain sites than others.

(Agency) Where there are invertebrates there may be bioaccumulation.

STUDIES IN THE TRANSPORTATION CORRIDOR

(SLR) In 2004 Bristol Environmental sampled every four miles along the proposed corridor and at five ponds. Later the sample area was divided into a Bristol Bay Drainage and a Cook Inlet Drainage and it was realized that there were many fewer samples in the Cook Inlet Drainage. So in 2005 additional samples for soil and vegetation were collected from the Cook Inlet Drainage, only one tundra pond was sampled in that area in 2005. In general there are similar amounts of data for both drainages now, with the exception that there is less pond data in the Cook Inlet Drainage simply because there are fewer ponds in the Cook Inlet Drainage. There have been no further studies since 2005. The road corridor has still not been finalized.

PLANT SAMPLING

(SLR) [Back to discussion on the mine site] ABR has categorized seven types of upland habitat types such as talus slopes etc...in a broad brush – large scale map. They will later come out with a final detailed habitat map, so the habitat type associated with some trace element samples may change. One-third of the soil sites were also sampled for plants, usually about four plant species per site were sampled. There are about 12 samples of each type of species. There were many species collected overall due to a variety of habitats. Plant species sampling also focused on including plants that have traditional uses and/or wildlife uses. The program followed a list of plants used for traditional uses throughout Alaska, that list will be redefined for traditional uses in the Bristol Bay area when the cultural/subsistence/traditional knowledge studies are completed. Most of the species on this traditional use list were collected, if they weren't it was only because they weren't present in the area.

(Agency) Were plants washed before sampling?

(SLR) This has been an issue in the Red Dog Studies where the dust is thought to be generated from truck traffic. At this site, there should be no difference between what's inside the plant and what is outside on the plant. We did not see a noticeable difference in trace element concentrations in plants after a rain than was seen in samples taken prior to a rain event and left unwashed.

(Agency) Six of one, half a dozen of the other. You want to know what's in the plant and what's on the surface.

(SLR) If the study is looking at the plant as a receptor and as an ingestion pathway - then you want to know what is inside and outside of the plant as a total; its location does not matter.

(Agency) It depends on the question.

(PLP) The Red Dog issue was also complicated by this issue of washing the plants, because the samples they collected were not washed, and had not been shaken, but the study results the plants were being compared to were from a study where the plants had all been shaken to remove loose dust prior to analysis. There are no standards to compare trace element studies to, so results are often used in a comparative analysis with other locations – if that is done, then similarity in sampling method is important.

(SLR) Moss holds dust well and is a good indicator species. "Willow" represents many species - they were identified to species so that we can refine the list of which willows are used in which way. We did take samples back to key out when necessary.

(Agency) Are there species with differences in metal uptake?

(SLR) We are still working through the data, but we are seeing some differences. It needs to be reviewed more before we come to any conclusions or release the data. In general, it appears that mosses and lichens take up the most metals. Some species of shrubs take up more metal than other species.

(Agency) Were sample ashed or dry weight?

(SLR) Dry weight.

(Agency) The mosses and lichens don't have root systems so they represent atmospheric uptake.

(SLR) Yes, it shows that air is a pathway for deposition.

(SLR) We saw no ferns out there.

(Agency) The samples in general are above ground and don't include the roots.

(SLR) We did try to extricate lichens from the rock matter in the samples as well.

(SLR) Key Plant Findings

- There are a substantial number of samples for statistical analyses
- Except for lead, values are usually lower in berries of a plant than in the rest of that plant's vegetative matter. Some natives use all of some plants, but not necessarily for ingestion.
- Values tend to be slightly lower in August than July – but we don't know why – going to the berries? Precipitation?

(Agency) Fluids transported to berries are regulated by the plant - different fluids going to the rest of the plant than to the berries?

(SLR) There are mechanisms that allow plants to maintain consistency in tissues, especially for essential metals. So you don't necessarily see trace element variability in plants correlate with that in soils.

(SLR) We tried to find uptake literature for cyanide in plants, but all the literature was related to mines and tailings which isn't relevant to what's occurring here in pretty much all of the media.

(Agency) Is 2 ppm a high value for cyanide?

(SLR) No. 100 would be high for toxicity standpoint for humans.

(PLP) Some of the values exceed water quality standards. The detection limit is barely below the standard.

SEDIMENTS

(SLR) The sediment program has had 14 sample locations that have remained pretty consistent over time. We take a single sample. We wade in, and collect the sample with a small corer. We try to stay away from areas with roots and plant matter and we also stay away from the gravels and try to collect the fines. The samples are not sieved, they are generally very fine sediments often similar to peat. Description of the fines is recorded in field notes.

(Agency) Sieving could separate out the invertebrates.

(SLR) May need a composite to get enough of an invertebrate sample.

(Agency) You need to give more consideration to site selection.

(SLR) We only have one year of data, two from the same pond. We were grouping by pond type for statistical meaning, so we were not treating individual ponds as separate entities. We were characterizing a group of ponds so we may not need 5 samples per pond, as we would if we were characterizing a single pond.

(Agency) Agreed if you are only characterizing.

(SLR) We were looking for variability in pond types, not for variability within a pond. Characterization and pre-term monitoring have different questions.

(Agency) Does the protocol avoid sand bars?

(SLR) We will need to look.

(Agency) It would be interesting to see if on a bar there is a difference at the end of the bar.

PUBLIC COMMENT

(Kendra Zamzow (CSP2) CSP2 recently wrote a letter about the data release and concerns related to that data. There was not an understanding of the difference between “baseline” and “preterm monitoring” when the letter was written. It was 106 pages of tables of data with zero text and it provided no information if duplicates or blanks were included in the data.

(SLR) It was just meant to be a raw data release. The EBD will provide context for the data. There is some indication of methods and labs used etc in the Study Plans and QAPP.

(Kendra) Was there any GRO sampling?

(SLR) No – we didn’t expect lightweight volatiles.

(Kendra) You should be able to show it consistently doesn’t show up with minimal sampling then.

(Kendra) The agencies and public want data questions addressed.

(Agency) Our agency agrees that we can’t make best recommendations without seeing a summary of the data. The data release is just tables of data dumped on the internet.

(PLP) The data release to the public at large is not a TWG issue. When the EBD is ready it will summarize the data. It is not ready yet, but people requested to see the data so it was released.

(Agency) We would like to get our hands on data that is not in PDF format.

(Kendra) Are study plans available to the public?

(Agency) Has all of the data been through QC, are data flagged or deleted because of QC?

(PLP) I will look into whether or not the data includes flagged data and if any data were removed and why.

(Agency) I would like to see the criteria used to accept or reject data.

(Agency) It seems QA/QC is based on best professional judgment.

(PLP) There are specific criteria. We will ask Jane Whitsett to attend the next meeting to discuss the QA/QC procedures.

NEXT MEETING

(Agency Lead) We should start forming an agenda to discuss at the next meeting. The Fish TWG had a Strawman monitoring plan to discuss. The Study Plans come out in January and the TWG should be ready to review those in February. I will pull together a draft agenda to distribute for the next meeting.

(Agency) For logistics for some members it would help to time the Geochemistry and the Trace Element TWGs closely together.

Ask Jane Whitsett to attend next meeting to discuss QA/QC for the data.

ACTION ITEMS

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| Criteria for differentiating between different types of ponds | PLP |
| Provide more information on site selection for sediment sampling at water quality stations. | PLP |
| Determine if the public data release includes duplicates and blanks in the data, are data flagged or deleted | PLP |