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Memorandum

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CC: Krista Koehl, Jim McKenna, David Ashton and Marcel Hermans – Port of Portland; Tom Schadt, John Verduin, PE, Todd Thornburg, and Elizabeth Appy – Anchor Environmental, L.L.C.

Date: October 18, 2007

Re: Laboratory Turnaround Time Specifications (Directed Comment Number 384); Port of Portland – Terminal 4 Early Action

This memorandum presents findings related to the ability of capable contract analytical laboratories to provide quick turnaround time (TAT) analysis of construction monitoring samples during the Terminal 4 Removal Action project implementation. The Environmental Protection Agency (EPA) comment 384 on the 60% Design Analysis Report (DAR) directed the Port of Portland (Port) to provide sample results to the EPA within 72 hours from the time of collection. Sample results that take longer than 72 hours from the time of collection to verbal or electronic delivery to EPA would be considered out of compliance with this requirement.

Based on the feedback from reputable laboratories, the Port reported that the shortest TAT that a reputable analytical laboratory has indicated they can provide is a 72-hour TAT from the time they receive the sample. (*See* IDR Resolution Table provided to EPA on September 21, 2007). This TAT is based on the assumption that there are no issues or problems related to the sample matrix, concentration, interferences, instrumentation, etc. During a meeting on Thursday September 27, 2007, EPA was receptive to a TAT based on 72 hours from the time the lab receives a sample to the time the results are provided to EPA. EPA requested a memorandum with detailed and specific information related to the Port's findings with respect to the TAT capabilities of the laboratories.

In response to EPA's request, laboratories were contacted again to obtain responses to specific questions related to their ability to provide a 48-hour and 72-hour TAT from the time they receive the samples, including pricing, courier logistics, and reporting logistics. The parameter

list, target reporting limits, and estimated number of samples provided to the laboratories was based on the Water Quality Monitoring Plan (WQMP) provided as Appendix D of the 60% Design submittal. Per the WQMP Section 2.4, during Tier I events, chemistry samples will be collected at one compliance boundary station (the station with the highest turbidity reading) and a background station. During Tier I events, chemistry samples will be collected at the surface, middle, and bottom depths. So, for each construction activity that is occurring, six samples per day will be collected for analysis for a minimum of three days. Additional samples will be collected if monitoring criteria are exceeded. During Tier II sampling events, a single sample will be composited from the surface, middle, and bottom depths at each compliance boundary and one background station, for a total of four samples on one day per week for the duration of the project. So, the number of samples the laboratory will receive will depend on the number of construction activities occurring at any one time and the sampling Tier of each construction activity. The laboratory could receive four samples in one day (assuming one Tier II activity is taking place) or up to 18 samples per day (assuming three Tier I activities are taking place). Additional samples will be included for quality control purposes. It is assumed that monitoring parameters will routinely include Cadmium, Lead, Zinc, and PAHs; DDTs and PCBs would be analyzed on a more limited basis.

Until the details of the T4 Removal Action are better defined and the construction timing is determined, Anchor recommends deferring final decisions regarding the TAT requirements for monitoring. Courier logistics will be addressed during design through a separate memorandum after project scope and timing is more certain.

Laboratory Feedback on Directed TAT

Analytical Resources, Inc. (ARI) in Tukwila Washington and Columbia Analytical Services (CAS) in Kelso, Washington were contacted to determine:

1. The estimated time needed for analysis and their capability to meet less than a 72-hour TAT (i.e. 48-hour TAT) from the time they receive samples.
2. What price structure they would require to achieve a 48-hour or a 72-hour TAT.
3. If they could provide courier pick-up of samples every 12 hours as needed.
4. Whether they could report results for each parameter as they become available rather than waiting for the entire suite of parameters for the sample or sample group to be completed before reporting.

1. Estimated Time Needed for Analysis

In order to determine the capability of the laboratories on TAT, the laboratories provided time estimates for each of the activities related to analysis and reporting. If the laboratories are required to achieve reporting limits at or below the chronic criteria for all COCs, the laboratories will need to run ultra low level methods for the PCB Aroclors and pesticides. This will impact the time needed for analysis as compared to standard level determinations due to sample preparation, extraction time, clean-ups, data evaluation, and trouble-shooting/re-analysis. Additional steps are needed during the sample preparation process over standard level procedures. For example, the glassware used for the extraction is baked in a kiln and must cool to room temperature before it is used for the extraction. In addition, the extraction time can range from 8-15 hours depending on the types of clean-ups required for each analysis to reduce matrix interferences at the trace level.

The low level methods also require more data evaluation time than standard level determinations. The low level detections can be very close to the signal to noise ratio for the instrument and must be carefully integrated and evaluated by an experienced chemist to ensure proper identification and quantification. There is an approximately 20 hour run time for each method. The data evaluation, review and reporting process takes about 8 hours per analytical batch for each method. An analytical batch is considered 20 samples or less and includes all QA/QC samples as well as bracketing calibration standard evaluations where applicable.

The time estimates provided by both laboratories for running the requested analyses, including low-level analyses for PCBs and pesticides, are provided below by lab activity. The time estimates provided below should be considered minimum requirements as they are based on achieving ideal conditions during the analytical process and do not include time to work through issues that may arise such as matrix interference or extraction difficulties.

- sample log-in (1.5 hours);
- sample extraction (6-15 hours);
- sample clean-ups (3 hours);
- instrument time (13.5 -20 hours);
- data review and interpretation (1.5 -7 hours); and,
- data reporting (1 hour).

These minimum time estimates are based on 10 samples being processed, for a total minimum estimate of 27 to 48 hours (low-level analysis). 20 samples would take at least 34 to 52 hours (low-level analysis) from the time of receipt to reporting. Both laboratories have indicated that these timelines are based on achieving perfect conditions throughout the analytical process and to meet these minimum timelines a seven day work week with two shifts would be required. Considering the laboratories do not operate around the clock, there is approximately 8 hours of downtime during which the sample may not be processed. This downtime is not accounted for in the time estimates. Accounting for laboratory downtime increases the minimum time estimates to 35 to 55 hours for processing 10 samples and 42 to 60 hours for processing 20 samples.

As stated previously, these time estimates represent the minimum amount of time required to run the analyses if no problems arise and do not include any time for addressing issues that arise during the analytical procedure such as re-analysis (e.g., if a detection requires further cleanup or dilution) or additional factors such as the laboratories' capacity and instrument maintenance requirements. These additional factors will impact the length of time required to complete any analyses as described in detail below.

Potential Analytical Issues that are Likely to Arise Routine QA procedures performed by the laboratory will impact the length of time it takes to analyze these samples. The large numbers of samples anticipated will have a direct effect on laboratory throughput. Low-level analysis methods require that all solvents be checked for purity prior to use in extractions. This purity check is routinely performed on each new batch of solvents. While the laboratories try to purchase large lots of solvents, they can only store up to a certain quantity. Analysis of solvents usually takes three to four hours for each new solvent batch. As more samples are processed, more solvents (and purity checks) will be needed. In addition, the need for working standards which are spiked into all field and QA/QC samples rises. Preparing and checking these standards can add up to 8 hours of QA/QC time for their verification analysis. Standards (internal standards, and continuing calibration standards) are used-up more frequently (with high sample throughput) and must be prepared and verified prior to using.

All glassware associated with trace analysis must be scrupulously cleaned. Because of their size (2-liters) only a limited number can fit into a kiln at one time. Additional kiln "dries" will add anywhere from 4-8 hours into the cycle. If glassware is not completely clean entire batches of samples may need to be re-extracted. In addition, instruments used for trace analysis must themselves be extremely clean and routine maintenance must be performed frequently.

Analytical columns degrade faster with high throughput and replacement is needed more often. It takes about 24 hours to remove an old column, install and condition a new column and recalibrate. Some sample matrix effects can degrade a column and contaminate the instrument. Sample re-extractions or dilutions that result in re-analysis will add to the overall sample analysis burden. If turbid samples are received, filtering prior to extraction will be required. Filtering can add up to 8 hours to a batch processing time. If the filtering is by-passed, the chances of emulsions occurring will increase. In some cases emulsions can be "broken," but typically they result in surrogate recoveries being lower and an increased need for re-extraction. Matrix interferences can result in failing continuing calibration standards and result in all samples from the previous passing continuing calibration needing re-analysis and to the overall sample analysis time. As some or all of these issues arise, the analyst will need to troubleshoot, diagnose and correct the problems. The amount of time it takes the analyst to diagnose and correct problems is difficult to quantify.

Capacity. The capacity limitations that impact TAT include the following:

- The time of year when samples would be collected is the busiest time of year for laboratories, so capacity is limited.
- If the samples require dilutions or the matrix is causing instrument or recovery problems (which is hard to predict), the time it takes to provide data will lengthen beyond the estimates provided above.
- CAS said the maximum number of samples they could analyze would be 20 samples per day.
- ARI said that lab capacity would be exceeded at 30 samples per week, although a dedicated instrument and analysts could be retained for an additional surcharge.

Instrument Maintenance Requirements. When analyzing a large volume of samples, routine instrument maintenance must be factored into the turnaround time that is required to continually run these samples over a period of time. It is difficult to estimate time requirements at this point, but it can typically require 24 hours for the instrument to equilibrate after maintenance is performed. The frequency of maintenance is highly dependent on the sample matrix. The ultra-low level methods for DDTs and PCBs generally require more maintenance time than the standard level due to the sensitivity required to achieve the required reporting limits. In order to run as many samples as possible before maintenance is needed, the laboratories would plan to perform any clean-ups wherever applicable on the samples.

Based on the information provided above, the minimum amount of time necessary (i.e., not accounting for the additional factors that are difficult to anticipate and quantify, but that need to be considered in the TAT described above) to complete the requested analyses is:

- 35-42 hours for analyzing 10-20 standard metals and organics samples
- 55-60 hours for analyzing 10-20 samples requiring low-level analyses of PCBs and pesticides

Therefore, given the minimum amount of time necessary to complete the requested analyses and the additional factors that need to be considered in the TAT, the labs would have trouble meeting a 48-hour TAT for standard metals and organics and would not be able to meet a 48-hour TAT for low-level analyses of PCBs and pesticides, which is required to meet reporting limits for chronic criteria. A 72-hour TAT is feasible for metals and organics if the analyses run smoothly and no issues arise, but would still be difficult to consistently meet and would be even more difficult to consistently meet for low level analyses of PCBs and DDTs when considering the potential for problems to arise during the analyses (e.g., sample requires dilution or additional clean up). Additionally, if the laboratory falls behind and does not meet the 72-hour TAT on one batch due to an issue such as matrix interference, it will have a hard time catching up unless there is a break in the number of samples delivered in subsequent days.

2. Price Structure

Both laboratories felt that as the details of the project develop with respect to the number of samples and delivery schedule they can better determine costs. CAS provided a $900 per sample estimate for a 72-hour TAT from the time the lab receives the sample for the analytes of interest. Most likely the laboratories would need to dedicate a number of staff teams to meet a 72-hour TAT. Due to the likely inconsistent number of samples analyzed per day this may be logistically difficult. ARI estimated the cost for a dedicated instrument and analysts would be $1000 for each day project samples are in-house. This cost is in addition to the cost per analysis on the project samples. By comparison, a "rush" (14-day) TAT typically costs $750 per sample and standard analysis costs $600 per sample while the T4 samples could be $900 per sample plus an additional $1000 per day. Based on the information provided in this paragraph, the daily laboratory cost of water quality analyses would range from $4,600 (analysis of 4 samples) to $17,200 (analysis of 18 samples).

Increasing payment to the laboratories will not result in decreasing the recommended TAT from 72-hours. The 72-hour TAT is based on logistics and feasibility, not the amount of money the Port is willing to pay. As discussed above, the 72-hour TAT already incorporates a premium price for the lab's commitment to the Port's project.

3. Courier Logistics

Both laboratories would provide courier service twice a day if needed. ARI estimated the cost at $180 per pick-up. Assuming samples are picked-up at 6 AM and 6 PM it is possible that samples picked up later in the day would not be processed until the next day. As the details of the project develop with respect to the number of samples and the laboratory capabilities, a pick-up schedule could be developed to minimize the amount of time between sample collection, arrival at the lab, and sample analysis.

4. Sample Reporting

The laboratories indicated they could report results for each parameter as they become available rather than waiting for the entire suite of parameters for the sample or sample group to be completed before reporting. Note that in advance of the remedial actions, a project meeting would be held with the laboratory to discuss coordination and develop a reporting plan. The reporting plan will identify expectations and responsibilities of the various parties involved in the project. To facilitate timeliness in reporting, the laboratory may be authorized to report

directly to the EPA. Results would be reported within the TAT. If analytical complications do arise, an explanation would be provided rather than the result.

Recommendations

Given the feedback received from the laboratories, Anchor recommends:

- A 72-hour TAT from the time of sample receipt at the laboratory to the time of providing the results to EPA. This would be the standard for compliance. Note that this recommendation is based on the level of effort as described in the introduction to this memorandum. Additional sampling requirements that may be specified as part of the 100% design or prescribed though "field changes" during construction will need to be discussed further.
- Courier logistics would be optimized after more details of the project develop. Most likely, samples would reach the laboratory within a maximum of 14 hours after collection (assumes pick-up every 12 hours).
- Results would be reported as soon as they are available to the Port within the 72 hour mandated TAT from the time the lab receives the sample. Therefore, if individual results are provided in a shorter timeframe than 72 hours, they will be reported as soon as available. However, as discussed with EPA, it is important that there is only one clear standard for assessing compliance (i.e., the 72-hour TAT). Multiple layers of reporting requirements may result in confusion, particularly given the potential number of samples and analytical results that could exist in one day.
- If analytical complications do arise and the 72 hour TAT from the time the lab receives the sample will not be met, an explanation will be provided as soon as the Port is made aware of the complication. This will not be considered out of compliance with the requirement. Given all of the issues described above that could influence sample reporting it simply may not be possible to meet the extremely stringent 72-hour TAT for a particular parameter of a particular sample 100 percent of the time. An occasional result that is reported late should not create a problem given the abundance of other field and chemical data that will be available to assess compliance with the criteria and evaluate whether corrective actions (if any) are necessary. Every reasonable effort will be made by the field team as well as the laboratory partners to keep the TATs to a minimum so that concerns are identified and addressed early.