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MEMORANDUM

To: CCOS Technical Committee

From: David Bush / Don Lehrman
Subject: Budget for PAMS monitoring at Denverton
Date: January 12, 2010

In preparation for our discussions during the upcoming Technical Committee Meeting on January 13, we have put together the following discussion of budgetary issues, including justification for our request for additional funds.

T&B Systems agreed to conduct three years of PAMS support monitoring, with the understanding that no more than $250,000 was available for the monitoring effort, including facilities and instrumentation as well as labor. To meet this budgetary goal, several concessions were agreed upon, most notably the reduction of actual monitoring months from 36 to 24 by interrupting monitoring during periods of lesser interest and utilizing borrowed surplus gas analyzers. Nevertheless, the original budget, excluding other direct costs, had $105,000 of labor remaining for locating and securing a site, site preparation, installation, operation, validation, and reporting for the 3-year monitoring effort. Meeting this tight but conceivably manageable budget has been made even more challenging by the operation of the key component of the monitoring effort – the ozone precursor continuous monitoring system – that essentially consists of the remote operation of GC components that until recently have been operated in a laboratory setting. Specifically, the budget left no room for unexpected issues or equipment problems, which unfortunately has not been the case, as discussed below:

- PAMS VOC Span Cylinder

Issue and justification: The high cost of the cylinder used to conduct span checks of the GC system ($6,800) was well known during the finalizing of the contract budget. Given the limited resources, it was assumed that one way of reducing costs would be to share an existing span cylinder with one of the BAAQMD's precursor monitoring sites. This has not been feasible, since daily span checks are necessary for the processing and validation of the data.

Cost: It is estimated that two cylinders will be required for 3 years of monitoring. The total cost over the duration of the project will be approximately $18,000. T&B Systems has already spent $7,500 ($6,800 + CA tax and shipping) to provide for a site-dedicated cylinder, outside of the original budget. Based on current consumption, it appears that the cylinder should last for approximately half of the 3-year period. Thus, a second cylinder will also have to be purchased. Furthermore, certification for these cylinders is required annually. Thus, an additional cost of $2,000 is required to recertify the original cylinder. Cylinder demurrage charges are additional.

Comment [dhb1]: Made up number. Can you see if you can get an actual number?

- Unscheduled Site Visits due to GC Problems

Issue and justification: Continuous GC monitors are presented by the vendors as being turnkey products that are perfectly suitable for unattended field operation. This is not borne out by the experience T&B Systems and BAAQMD have had to date. This is not surprising given that these pieces of equipment have until recently been restricted to a laboratory environment. The complexity of the system is illustrated by the effort required by the manufacturer, PerkinElmer to

get the Denverton unit to its current stage of operations: senior technicians flown in from Washington and Florida over a 6-week period in addition to their local technician. While the system design has come a long ways towards continuous operation, the system is still prone to shutdowns, which are easily dealt with if the site is attended (such as the BAAQMD Livermore site. For sites that are more remote, such as the Denverton site, unscheduled visits consume significantly more resources.

Cost: Based on review of the site logs, to-date we have made seven trips to this relatively distant site solely to address problems associated with the precursor monitoring system. Typically this is to restart the system due to a shutdown, sometimes due to power failures but also due to other unexplained reasons. To date, the unanticipated visits have cost approximately $5,000. While we are hoping that the number of unscheduled visits will drop as system bugs are eliminated, some unscheduled visits will be required in the future and that contingency must be budgeted.

- Unanticipated Data Processing Costs – Data Processing Procedures

Issue and justification: While PerkinElmer has definitely made progress towards a field-worthy continuous monitoring instrument, the software used to process and validate the data remains essentially the same as that used for a laboratory based system. Consequently, some software features and capabilities, while suitable for laboratory operations, are not particularly functional for the processing and reporting of continuous data. The output data files are in an ASCII format that is not easily imported into a useable database structure. Furthermore, two files are created for each hour of data, resulting in nearly 1500 files per month. Rather than manually dealing with this number of files, we created software that merges these files and reformats the data to a useable spreadsheet format. Using this monthly file, it becomes much easier and quicker to review the data and identify discontinuities.

Cost: About 75 hours of labor ($6,400) were spent designing a processing methodology and writing and testing the data merging software. This was an unanticipated and hence unbudgeted effort.

- Unanticipated Data Processing Costs – Full Data Validation

Issue and justification: Again, vendors emphasize the automation of the data processing procedures. However, the fact remains that this is essentially a laboratory piece of equipment, and processing of fully validated data requires a considerable amount of manual review and manipulation of the chromatograms. We have developed review procedures using batch processing capabilities that we believe will provide usable, accurate data for 90% of the compounds without further effort. Data validation to this level can be conducted under our stated budget for this task. However, there are a few areas on the chromatograms where the peaks are so close that reliable automatic detection is not possible. Thus, to fully validate these compounds, a more intensive manual review effort is necessary, which was not budgeted.

Cost: PerkinElmer, during their training session, indicated that it would take 1 to 4 hours of labor per day of data to conduct this type of manual processing and review. We estimate that we can conduct the detailed processing and review of data for $150 per day of data. The number of days requiring this degree of validation will need to be determined by the goals of the monitoring effort, including whether or not the problem compounds are of critical interest.

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- Repair of NO_x Analyzer

Issue and justification: In an effort to reduce ODC costs during the proposal stage, the decision was made to conduct the ozone and NO_x monitoring by borrowing retired yet functional analyzers from the BAAQMD. No budget was provided for the repair of these analyzers, relying instead on the wishful thinking that no spare parts or repairs would be needed. To put this in perspective, monitors could have been rented for the program for about $800/month ($19,000 for 24 months of monitoring) for each analyzer, at which point the leaser would be responsible for repairing the analyzer. Or alternatively, new analyzers and accompanying spare parts could have been purchased for approximately $12,000, whose performance would have been covered by warranty for at least a portion of the study, and would likely have provide reliable service over the 3-year period.

The borrowed Thermo NO_x analyzer failed after about two months of operation. Symptoms indicated that the problem was due to either the photo multiplier tube (PMT) or the PMT power supply, or possibly both. Tests showed the latter had obviously failed and could be easily replaced. The former, however, could not be easily determined without a functioning power supply, was expensive, and required specific expertise in replacing. Under these circumstances, we proceeded on-site with the easy fix of the PMT power supply, only to find that the PMT was also bad. At this point, the analyzer was removed and sent to a third party for repair.

Cost: $6,000 was spent to repair the analyzer, including approximately $2,000 for parts. Due to "wishful thinking" that the analyzer could be repaired on-site, additional trips to the site were conducted which could have been avoided if the analyzer had been shipped immediately to the third party for repair. To keep costs at a minimum, we elected to work with a 5-week turnaround, which significantly reduced the cost of the replacement PMT. During this period, we provided a replacement NO_x analyzer, at no cost to the project and not included in the above value. Having learned our lesson regarding use of third party repair, efforts for future repairs should be limited to the $1,000 to $2,000 range.

Comment [MSOffice2]: Not sure how to interpret this. Should the unit be removed immediately and sent to third party.

Comment [MSOffice3]: Should we recommend leasing two analyzers?

- Meteorological Tower

Issue and justification: The original contract specified that we would provide meteorological measurements for a 6-month interim period while the ARB established their air quality site in the vicinity, after which meteorological measurements would be provided by the ARB. We will have provided 6-months of meteorological data at the end of January 2010.

Cost: $450/month. This includes rental costs for the sensors, tower, the portion of the site lease specific to the presence of the tower, and 2 hours of labor. Note that since the tower and meteorological sensors are committed to the site until the tower is decommissioned, this cost will apply even during periods when the gas analyzers are not being operated.

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Summary

Costs discussed above can be divided into two categories: unbudgeted costs spent to date and potential for additional unbudgeted costs. These are summarized in the table below:

	Item	**Cost**
Spent to date	VOC span cylinder	$7,400
	Unscheduled site visits - GC	$5,000
	VOC data processing issues	$6,400
	NOx analyzer repair	$6,000
Potential additional costs	VOC span cylinder	$7,800
	VOC cylinder recertification	$2,000 Estimate
	Unscheduled site visits - GC	$750/visit
	Full VOC validation	$150 per day of data
	Analyzer repair	$1,500/incident
	Meteorological measurements	$450/month

In summary, about $24,800 has been spent on unbudgeted efforts, 10% of the $250,000 budget. Of the potential additional costs, the $9,800 associated with the VOC cylinder is unavoidable in order to complete the 3-year monitoring period. Assuming the need for 24 additional months of meteorological measurements, the cost for these measurements is an additional $10,800. The additional effort for full validation of the VOC data, if desired, will need to be estimated based on the goals of the monitoring effort. Finally, the cost of any continued unscheduled site visits to deal with remaining VOC monitoring system issues and any further analyzer repair efforts cannot, of course, be fixed. However, it would seem that a $15,000 contingency fund could be established to cover these costs, requiring documented justification prior to release of the funds.

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