

# **PERFORMANCE REPORT**

## **Quality Assurance Program - July to December 2011**

The following discussion is prepared in accordance with the requirements for a Semiannual Performance Report on the Quality Assurance Program. This performance report evaluates data used for the Semiannual Report and for the routine third and fourth quarter 2011 water and environmental/occupational monitoring reports. This Quality Assurance Program Performance Report summarizes the data review and assessment processes for validation of quality control samples and quality assurance verification and assessment of sample related data.

Assessment of Cotter generated data consists of the following activities:

- Review of field data and sampling practice by sampling and quality assurance personnel.
- Review of Sample Submittal Tracking Forms (SSTF), chain of custody, and LIMS log-in documents by quality assurance personnel.
- Review and approval of the samples and QC sample data on a sample-batch basis by laboratory personnel.
- Review and approval of sample results and QC data on a sample-batch or LIMS “WorkSheet” basis by quality assurance personnel.
- Investigation of questionable or non-compliant data and subsequent follow-up.
- End-user (“Data User”) data review.
- Monitoring and reporting of QC related performance criteria by quality assurance personnel.

Cotter assessment of reported data generated by non-Cotter offsite laboratories consists of similar activities:

- Review of Sample Submittal Tracking Forms (SSTF), chain of custody, and LIMS log-in documents by quality assurance personnel.
- Cotter “Data User” data review.
- Investigation of questionable or non-compliant data and subsequent follow-up.

During any of these activities, corrective action follow-up may entail undocumented immediate request for needed investigation or corrections or the formally documented Data Request (DR), Data Verification Request (DVR), or Corrective Action – Improvement Request (CAIR) processes.

## QUALITY CONTROL VALIDATION -

The May 22, 2009 Revision of the Quality Assurance Program Plan for Environmental and Occupational Sampling and Monitoring Studies for the Cotter Corporation, Canon City Milling Facility And Lincoln Park, Colorado Superfund Site or “QAPP Manual” established Program Performance Criteria which specify quality control and quality assurance requirements. The Program Performance Criteria require quality control data processing and data qualification or flagging. Specific to this report the Program Performance Criteria require: 1) Calculation and monitoring of the “Total Uncertainty” (TU) of accuracy (Matrix Spike) and precision (Laboratory Duplicate) sample results; 2) Determination and monitoring of batch sample result “Usability” based on TU and/or related quality control factors; 3) Monitoring the percent of qualified or “flagged” data on sample batch basis; 4) Calculation and monitoring of data “Completeness”; and 5) Monitoring and control of specific analyte detection limits.

To accomplish these requirements quality control validation begins with review of the analytical records documented in the “WorkSheet” (sample batch) data packet. Packet contents are inventoried and any batch specific notations are reviewed. Sample results and detection limits are evaluated. Quality control calculations are validated. Quality control results are evaluated for acceptability or requirement for qualification indicator (“flagging”). The WorkSheet’s per cent Total Uncertainty value (%TU) is calculated and recorded. Sample batch usability is determined and recorded. From these data packet reviews, Worksheets containing qualified data are tracked and the percent of data completeness is determined. The data validation review and status of each WorkSheet Data Packed are summarized in the “Cotter Lab Data Validation Record” (tabulation) maintained in the Quality Assurance Department electronic files.

The %TU, usability, data qualification/flagging and completeness are being determined and recorded by the data reviewer. The Quality Assurance Department has developed an excel spreadsheet which processes and records the %TU and associated results. This spreadsheet automatically calculates %TU, determines data usability, and documents qualifier flagging for the sample batches containing matrix spike and duplicate data. The usability of data in sample batches not containing matrix spike and/or duplicate quality control samples is also determined and recorded in the %TU spreadsheet. Qualifier flagging for Laboratory Control sample (LCS) or Prep Blank quality control failure is recorded manually in the %TU spreadsheet. Compliance with detection limit controls and the percentage of qualified data within a sample batch are determined manually. Data completeness is determined from queried LIMS records and TU-usability determination summaries.

A total of 449 analyte Worksheets (sample batch) Data Packets were processed by the QA Department for this report. Quality review and assessment has been completed on all data within these data packets. An additional 49 WorkSheet Data Packets are awaiting final review and approval by the Quality Assurance Department. There are 32 WorkSheet Data Packets not included above which are currently undergoing some form of QA follow-up activity. Beyond the quality assurance completeness statistics reported in this QA Performance Report, the ongoing quality assurance finalization is not expected to affect data reported to data users.

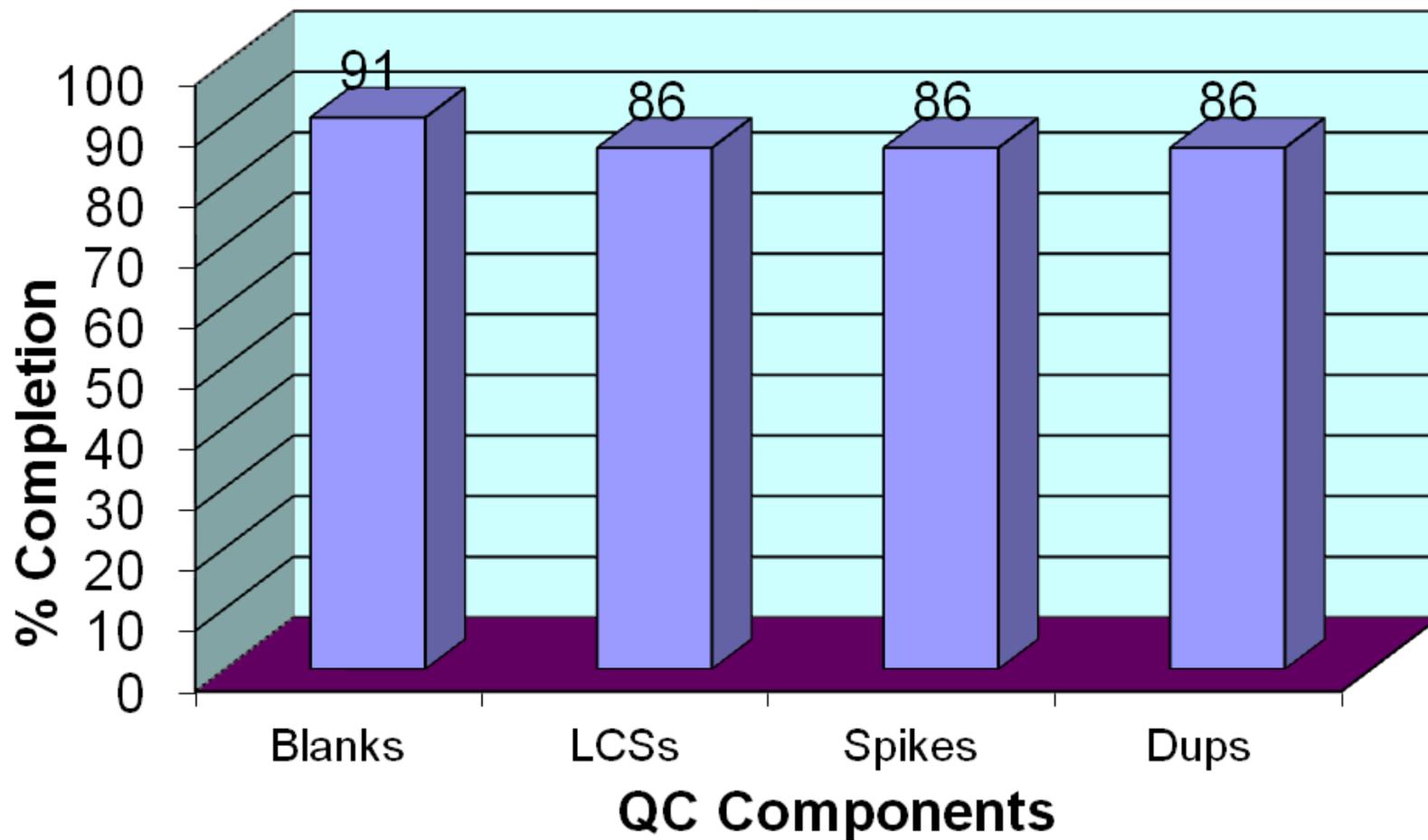
The data of all 449 WorkSheet Data Packets approved by the Quality Assurance Department were determined to be “usable” data. “Data Completeness” is 99.6%” for the 449 WorkSheets processed. 261 of the WorkSheets reported acceptable TU values ranging from 0 to 27.3% Total Uncertainty. 188 did not allow TU calculation but were determined to be usable. Two WorkSheets contained flagged or “qualified” data. The data from both of the flagged WorkSheets was determined to be “usable”. Both of these “qualified” sample batches consisted of water samples and contained a quality control duplicate sample result which did not meet the acceptance criteria range. The one sample batch consisted of experimental test samples analyzed for dissolved potassium. The other sample batch contained two duplicate water samples analyzed for suspended uranium. The first duplicate sample in this batch contained suspended uranium above the detection limit and easily met the QC duplicate Relative Percent Difference acceptance criteria. The second duplicate sample’s original uranium content was zero while its duplicate sample result was just over the detection limit and provided a Relative Difference value of 1.07 (RD acceptance limit is 1). The Cotter Quality Assurance Department subsequently identified the batch’s QC as “acceptable” under the alternate acceptance criteria allowance of QAPP Section 10.2.2. Notations were made in the WorkSheet records, in the TU spreadsheet, and on the individual WorkSheet Data Packet Quality Control Sheets.

The overall percentages of completion of the quality control validation at the time this performance report is being written are depicted on the accompanying Graph PRQ1, *Quality Control Validation – Second Half 2011*. The depicted quality control validation completion percentages are estimated to be 91% for QC blanks and 86% for each of the other three QC data types. The reduced percentage completion values may be attributed to three factors: (1) 82 WorkSheet Data Packets are awaiting final QA Department approval. (2) A detailed trend chart analysis has not been performed. (3) Automated LIMS qualification of data is not yet implemented.

Graph PRQ1

## Quality Control Validation

Second Half 2011



## QUALITY ASSURANCE VERIFICATION -

General quality assurance verification may include evaluation of sampling and/or analytical procedures and activities, program or project design and activities, and data processing and reporting. In addition to the review activities discussed above, the data contained within the report undergoes other types of QA verification assessment. The basis for the additional data verification assessment may include historical knowledge of constituent levels, radiochemical equilibrium ratios, material-specific constituent proportions, known environmental conditions, and comparisons of final results to preliminary screening data. Data verification may also include evaluation of the reported detection limits versus required detection limits and the effect of failed QC samples on data usability. Discovery of questionable, unacceptable, anomalous, or unexpected results is followed by a review of field or lab records, investigation of sample acquisition, handling, preparation or analysis, or a request for reanalysis. The Cotter Quality Assurance Department provides oversight and documentation of required formal quality assurance data verification and follow-up.

A number of data quality investigations were documented by the Quality Assurance Department during the time period covered by this report. There were two Data Requests (DR) recorded. Both were for additional new analyses of third and fourth quarter occupational air samples or composites. Eight quality assurance related Data Verification Request - Assay Correction Form investigations (DVR/ACFs) were generated by data reviewers and data users. The Cotter lab was responsible for responding to seven of these - three for groundwater, two for environmental air, one for urinalysis, and one for in-house laboratory quality assurance proficiency testing. A commercial lab was responsible for responding to the remaining DVR which addresses an environmental radon result. All have been resolved except for the QA proficiency test result and the environmental radon sample results (commercial laboratory). The DVR/ACFs addressed a total of 54 sample results.

Not all data verification investigations result in required data correction when resolved. Although a value reported for an environmental air sample uranium result was verified through reanalysis; some form of further investigation is planned. Six Corrective Action - Improvement Requests (CAIRs) related to the focus of this QA Performance Report were issued during this reporting period. Two dealt with gross alpha determinations of occupational air samples. The third requested formal documentation of pragmatic relief from broadly applied quality control requirements in the radiochemical analysis of occupational air samples. The fourth requested implementation of a data validation process requiring peer review of environmental air sampler exposure weight calculations and LIMS input. Two additional CAIRs dealt with general QC evaluation of ICP-MS analytical data. The QA Department also conducted seven quality assurance assessment "Evaluations" during this reporting period. Four focused on environmental sampling and monitoring procedures and practices. Three addressed quality assurance of uranium in urine. An internal assessment of Cotter's LIMS up-date and alternatives is on-going.

This Quality Assurance Program Report focused on evaluation of environmental and occupation air and groundwater monitoring data quality. The related quality assurance verification assessed data that can be categorized roughly into the following three sample categories: Environmental Air, Occupational Air, and Water Monitoring. At this time, the overall percentages of completion

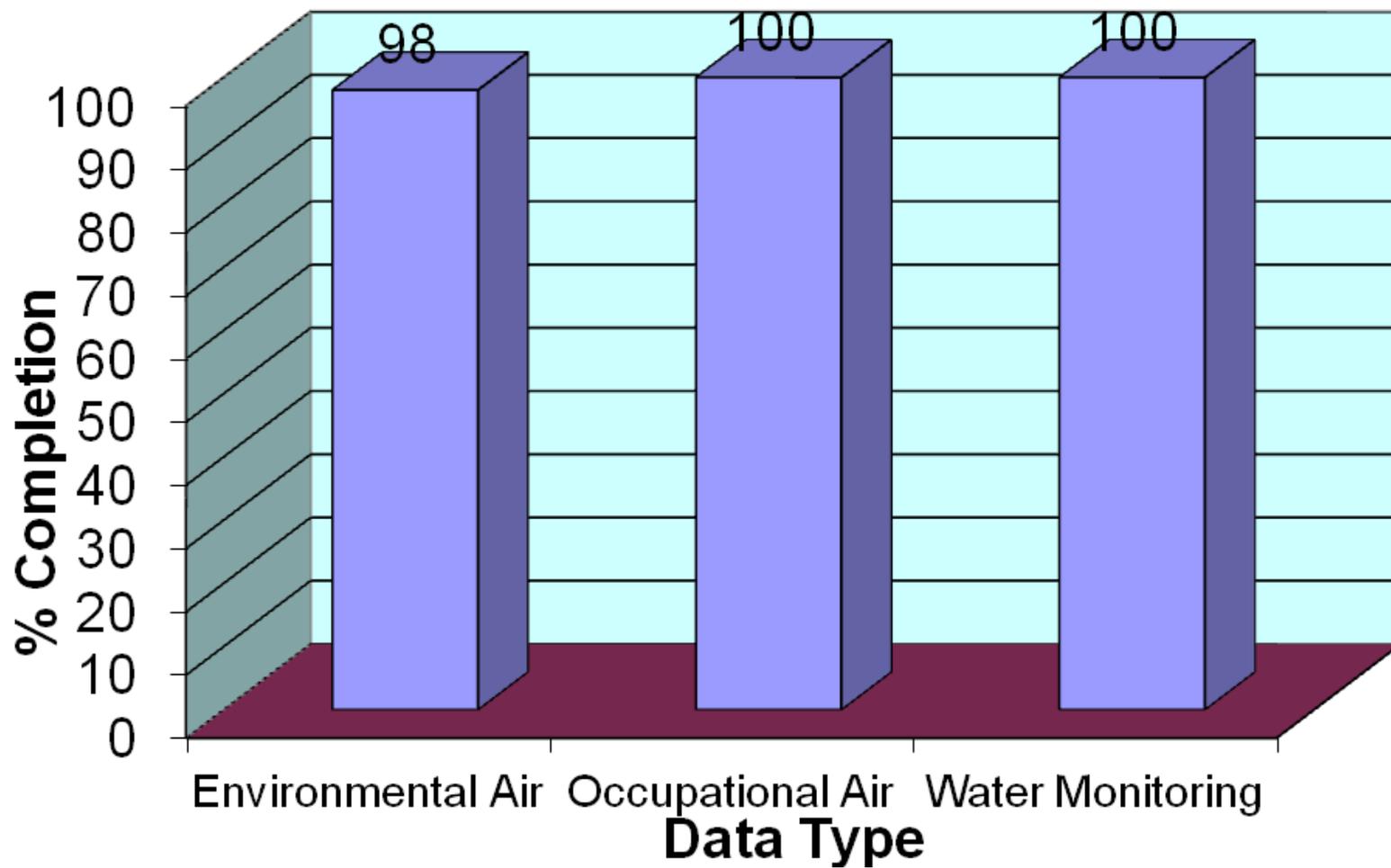
of quality assurance verification are believed to be 98% for Environmental Air and 100% for Occupational Air and Water Monitoring. The conclusions of the follow-up on the radon and uranium samples' results mentioned previously are pending. The percentages of completion of each category are depicted in graph PRQ2, *Quality Assurance Verification - Second Half 2011*.

The attached Error Analysis – Second Half 2011 Tables 1 and 2 summarize potential data errors that were identified during the data quality assessments. Table 1 addresses quality control validation issues. Table 2 addresses quality assurance verification errors.

Graph PRQ2

# Quality Assurance Verification

Second Half 2011



**Table PRQ1  
Error Analysis – Second Half 2011**

**Quality Control Validation Issues**

Description	Samples Affected	Frequency of Occurrence	Does Pattern Exist? Explain	Resolution
<p>1) The methodology used to assess quality control accuracy and precision data in the LIMS (Aspen) is not consistent with the methodology prescribed in the QAPP. 2) Data qualification</p>	<p>Blanks, Duplicates, Spikes, and LCSs.</p>	<p>Numerous</p>	<p>Yes. These issues will exist until a LIMS customization is complete and any required modifications to the QC processing sections of the LIMS have been completed.</p>	<p>Modification and customization of the Cotter LIMS is ongoing. The LIMS QC Summary report sheets are used primarily to verify proper data entry/data upload into the LIMS. Manual QC review and approval will continue to be performed using calculations docum</p>
<p>Manual data input or transfer can result in erroneous information in analytical documentation and/or within the LIMS database.</p>	<p>All data</p>	<p>Estimated to be &lt; 5%.</p>	<p>Not consistently. Due to the large volume of data that is manually input occasional random data entry errors are likely.</p>	<p>These types of errors are detected during internal laboratory and QA/QC data reviews. Corrections are made to the documentation and/or the LIMS database, as necessary. Once data is input or produced in a transferable format it is transferred (imported or</p>
<p>Inaccurate and/or inconsistent labeling of quality assurance blank samples is misleading and leads to incorrect application of quality control and quality assurance assessments.</p>	<p>Preparation, Prep, Digestion, and Reference Blanks and Blank-Reference samples</p>	<p>Common and frequent occurrence especially in ICP-MS sample batch records.</p>	<p>Yes. This confusing and inconsistent nomenclature is encountered throughout many metals and radiochemical analyses records.</p>	<p>Standardized sample nomenclature should resolve this issue. CAIR 295 documents a request made to the lab personnel to revise the wording that defines the various blank samples in Lab Procedure 2-200 and to standardize the labeling of the various blank sam</p>

**Table PRQ2  
Error Analysis – Second Half 2011**

**Documented Quality Assurance Verification Errors**

<b>Document or Record</b>	<b>Sample/Result Type</b>	<b># Results Affected</b>	<b>Apparent Error Type</b>	<b>Results of Investigation</b>	<b>Does Pattern Exist? Explain</b>
DVR/ACFs: 11-22-2011-1, 11-23-2011-1, 12-12-2011-1, 2-10-2012-1, and 2-22-2012-1	Groundwater, Environmental Air, Urine	13	Suspect or anomalous results requiring reanalysis.	Reanalysis was performed followed by correction in laboratory WorkSheet Data Packet and LIMS database when required. Some original results confirmed. Sample contamination suspected in some cases.	This problem is usually detected during data user QA review of results and is usually followed by a request for reanalysis. Only formal documented requests resulting in sample result changes are tracked here.
DVR/ACF 11-22-2011-1	Groundwater	8	Dilution Error	Error detected and sample either reanalyzed or data reprocessed.	This problem encountered more often when gaining experience with new analytical instrumentation and developing new procedures.
DVR/ACFs: 11-22-2011-1 and 2-10/2012-1	Groundwater and Environmental Air	20	Input Error	Data recorded incorrectly on data processing worksheets or during entry into electronic file.	'This is a fairly common error associated with manual input and transfer of data. This problem is frequently detected during review of manual calculations and hand entry, lab results and comparisons with historical data.
Field Logs, Chain of Custody SSTF Forms, Sample Evaluation Worksheets, Hand Calculations Sheets, Procedural Records.	Environmental and Occupational	Variable	Misinterpretation or misidentification of field data	Data reviewed and discussed. Chain of events reconstructed and reevaluated. Corresponding records consulted. Corrections made when discovered or verified. Retraining often provided.	This problem is often detected during data user or QA reviews and can be common with manually collected and recorded data and when implementing new activities or employing new personnel.

Note: 17 analytical results were investigated and verified through the DVR/ACF documentation and required no change in reported values.  
 A sample result may be affected by more than one error type.  
 Data verification and subsequent correction of specific sample results often results in additional correction and revision of associated samples.

# Performance Report

## Laboratory Program July – December 2011

This report describes the types and numbers of analytical determinations as well as the dates the results were posted to the Laboratory Information Management System (LIMS). All of the data was available by December 26, 2011 except as noted below. Some of the measurements, for example, “perimeter” or environmental air sampler filter paper weights and urinalysis for uranium, are typically posted within a week or two of collection.

### Analytical Work Summary -

- Gross alpha/beta breathing zone and general area air samples filters were collected and submitted by Radiation Safety Department technicians for assessment of airborne concentrations relative to the ALARA program and to monitor occupational dose. The sample load resulting from this analysis was two thousand fifty (2050) samples for the second half of the year. Preliminary results were either available within twenty-four (24) hours of sample receipt or by the next business day for samples collected on weekends. Final analysis of these samples in all cases was completed well within the report preparation requirements.
- Third (3rd) and Fourth (4th) quarter anion analyses - one thousand three hundred seventy (1370) analyses entered into LIMS no later than 01-10-12
- Three hundred thirty (322) perimeter (environmental) air sampler filter weights each weighed twice (644 data points) entered into LIMS by 12-28-11.
- Occupational air, perimeter air, and water for total uranium - 2680 analyses by ICP-MS totaling two thousand six hundred eighty (2680) sample analyses entered into LIMS by 01/09/12.
- Perimeter air and water analyses for  $^{226}\text{Ra}$  – one hundred (100) sample analyses.
- Perimeter air and water analyses for  $^{210}\text{Pb}$  – ninety (90) sample analyses.
- Water analysis for  $^{210}\text{Po}$  – sixty-six (66) sample analyses.
- Occupational air, perimeter air and water analyses for  $^{230}\text{Th}$  - one hundred sixty six (166) sample analyses.
- Occupational and perimeter air analyses for  $^{232}\text{Th}$  – ninety (90) sample analyses.
- Uranium in urine analyses - nine hundred fifty two (952) sample analyses.
- pH and conductivity of water sample determinations - one hundred thirty (130) sample determinations.
- Gross alpha & beta analyses of sediment - fourteen (14) samples analyses.
- Third (3rd) quarter analyses for metals: Ca, Fe, K, Mg, Mn, Mo, Na, and Se – six hundred ninety five (695) analyses by ICP-MS entered into LIMS by 10-05-11
- Fourth (4th) quarter analyses for metals: Ca, Fe, K, Mg, Mn, Mo, Na and Se - seven hundred forty seven (747) analyses by ICP-MS entered into LIMS by 02-09-12.