LANL's Monitoring of Low-Level Tritium in the Buckman Well Field

Buckman Direct Diversion

Board Meeting

April 5, 2012

Danny Katzman

LA-UR-12-20257

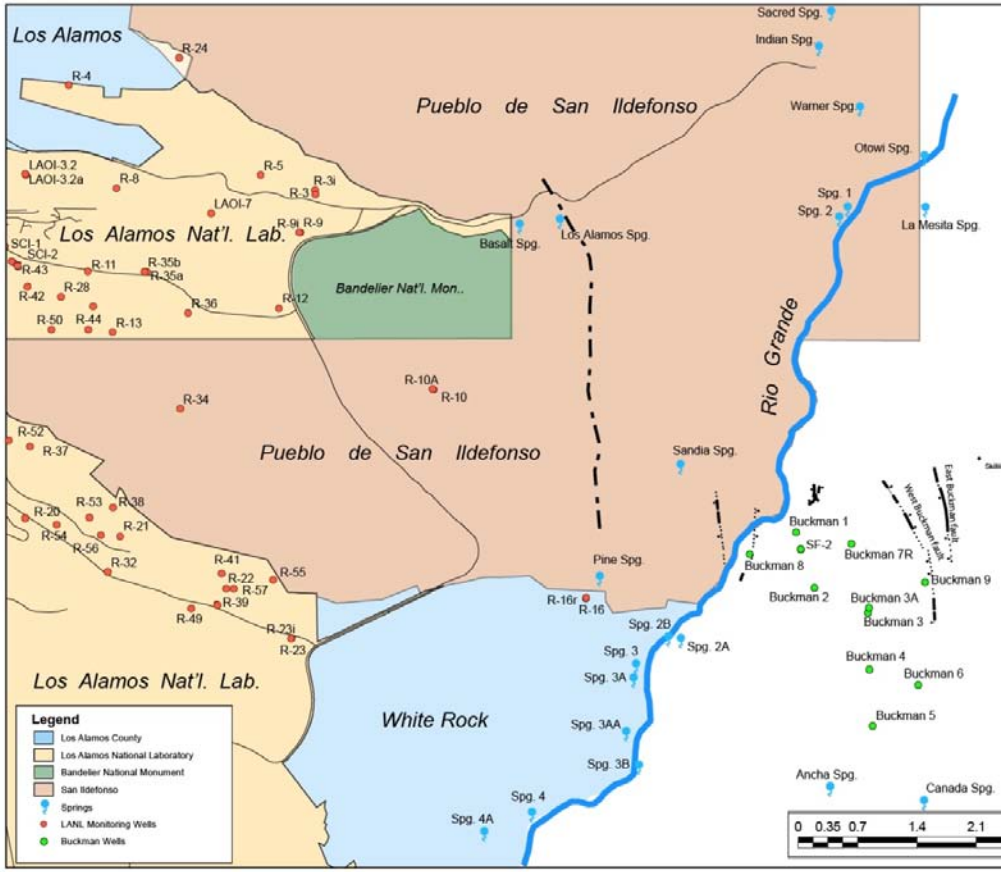
UNCLASSIFIED

Presentation Outline

- **LANL's History of Monitoring in the BWF**
- **Tritium Monitoring**
- **Resolution of Recent Tritium Analyses**
  - Buckman Well Field continues to show absence of tritium in water-supply wells

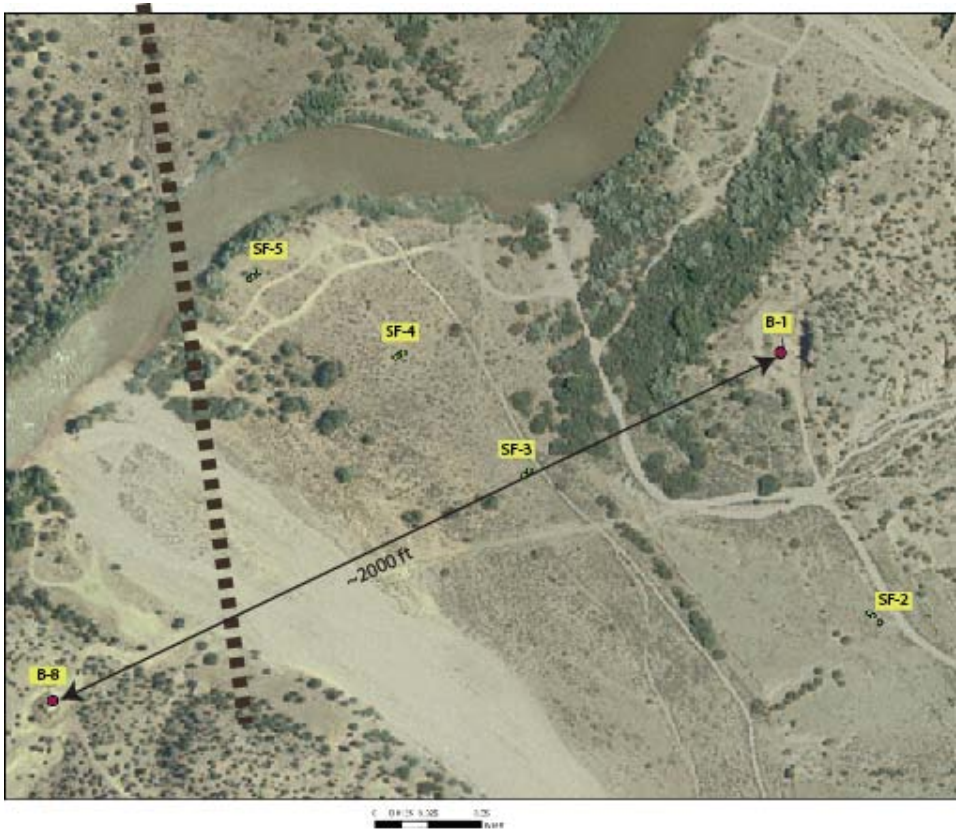
LANL's History of Monitoring in the BWF

- **Supplementary monitoring by LANL in the BWF since 2001**
- **Conducted voluntarily to supplement Safe Drinking Water Act monitoring suite**



Monitoring in the BWF (cont.)

- Monitoring conducted quarterly in three water-supply wells, B-1, B-6, B-8
- Samples are analyzed for variety of constituents including the most mobile constituents potentially associated with LANL, e.g.,
  - Chromium
  - Nitrate
  - Perchlorate
  - Tritium
- These constituents are also naturally occurring



Purpose of Low-Level Tritium Monitoring

- **Tritium is present everywhere in the environment**
  - Precipitation and Rio Grande water in northern NM is 15-25 pCi/L
  - Groundwater standard is 20,000 pCi/L
- **Used to determine if groundwater is connected to sources of tritium in the environment**
  - Residual tritium from above-ground nuclear testing
  - Tritium from past or current LANL sources

Tritium Monitoring

- **Two types of analytical methods for tritium**
  - One method has detection limit (minimal detectable activity, MDA) of 200-300 pCi/L
  - Low-Level tritium (LLH3) method has an MDA of ~3–5 pCi/L
  - Not an EPA-approved method
- **2000-2008 - University of Miami**
  - Research laboratory
    - Internally consistent data quality
    - Slow and inconsistent turnaround on results
    - Insufficient QA/QC paperwork
- **2008 to present – American Radiation Services Laboratory**
  - Commercial Laboratory
    - Non-routine analysis
    - Improved turnaround on results (still requires addtl 30-day hold for BWF data, 75-day for BDD data)
    - Appropriate QA/QC paperwork
    - Initial problems with tritium results

Resolution of ARS Tritium Data Quality Issues

- **LANL identified several examples of tritium results from ARSL that were inconsistent with prior observed concentrations**
- **LANL brought tritium data-quality concerns to attention of ARSL and Analytical Quality Associates (AQA)**
- **AQA contacted ARSL triggering an internal assessment by ARSL**
  - Identified two sources of errors
    - Rounding errors
    - Incorrect calculation of results from analytical instrument

Resolution (cont.)

- **ARSL issued a nonconformance report**
  - Root-cause analysis
  - Corrective Actions to eliminate the errors
- **ARSL reissued complete analytical packages to LANL**
  - Corrected values
- **LANL provided information to City of Santa Fe for independent review**
- **Upon approval from City of SF, LANL issued corrected tritium values**
- **Available on public database – Intellus (formerly RACER)**

Summary

- **In mid 2008, LANL changed analytical laboratory used for low-level tritium analysis**
  - better and more complete QA/QC packages
  - substantially improved turnaround on results
- **Based on data for the period of record, tritium is not present in the samples from the Buckman Well Field**
- **LANL continues to monitor within the BWF**

Questions?

Nonconformance Report

NCR #: 11-1308
Assigned by QAO

Part A: Initiator (Deficiency Identification)

Describe Nonconformance:

1. Spreadsheet used for calculation of Low Level Tritium (LLH3) had cells formatted to round the values to the nearest whole number rather than using additional significant figures to calculate the activity of the LLH3.
2. DPM rather than CPM entered in spreadsheet for results reported for 18 samples from ARS batch ARS1-B10-05618 (LANL 11-473, 11-474, 11-571, 11-556, 11-564 (3 samples)).

Multiple	ARS-040
ARS Batch No.	ARS Procedure No.
Low Level Tritium	Electrolytic Enrichment
Analyte(s)	Method
Multiple - LANL	
ARS SDG(s)	

Virgene Mulligan	Virgene Mulligan	09-08-2011
Initiator's Signature	Name (print)	Date

Nonconformance Report

NCR #: 11-1308
Assigned by QAO

Part B: Responsible Manager (Investigation and Proposed Resolution)

1) Did this nonconformance affect analytical results? ◉ Yes ○ No

If Yes:

Identify affected client(s): LANL

ARS Sample ID(s) / SDG(s): Multiple

2) Is client contact required? ○ Yes (Part C Signature Required) ◉ No

3) Cause of Nonconformance:

All data calculations for Low Level Tritium are performed manually and are not connected in any way to the Laboratory Information Management System. The spreadsheets being used for LLH3 calculations had been manually verified and all cells had been locked and the spreadsheet was password protected. It is not clear how the rounding in the calculation occurred.

The DPM vs CPM issue occurred as a result of manual data entry. Values for the activity were very similar to the screening activity (i.e. LLH3 activity 93, screening activity 90); therefore, the fact that DPM rather than CPM was used in the calculations was not evident during data review.

4) Proposed Immediate Resolution Proposed Completion Date: 10-07-2011

Is retesting of sample required? ○ Yes ◉ No

Has Nonconformance item(s) been tagged Out of Service? ○ Yes ◉ N/A

Immediate Resolution Actions(s): *CAR Required* ◉ *Yes* ○ *No*

See attached

Long Term Action(s):

Susan Leese, Virgene Mulligan

Person(s) assigned to Implement Resolution

Virgene Mulligan

Responsible Manager's Signature

10-05-2011

Date

Nonconformance Report

NCR #: 11-1308
Assigned by QAO

Part C: QAO (Evaluation)

1) Route to Project Manager for Client Notification ☒ **N/A**

Project Manager's Signature — Date of Notification

2) Notify Regulation Body ☒ **N/A**

QAO's Signature — Date of Notification

3) Execute Immediate Resolution and Establish Completion Date ☐ **N/A**

Susan Reese — Responsible Individual's Signature
10-5-11 — Completion Date

4) Execute Corrective Action and Establish Completion Date ☐ **N/A**

Eugene Mulligan — Responsible Manager's Signature
2-7-12 — Completion Date

5) Nonconformance Category (*Select Only One*)

○ PT Results	○ HS&E	○ Equipment
○ Batch QC Results	○ Contractual	○ Software
○ Instr. QC or Malfunction	○ Procedural	○ Prep
○ Missing or Defective Data	◉ Reporting Errors	○ Other

Additional Category Detail (e.g., Blank, LCS, Chemical Yield, Background, Lost Sample, etc?)

Verification

Immediate Resolution Verified Complete: 10-05-2011 (Date) ☐ **N/A**

Corrective Actions Verified Complete: 02-07-2012 (Date) ☐ **N/A**

QAO Comments:

Programming is complete and all calculations have been verified. All other actions were completed 10-05-11. 2710 vrm

Eugene Mulligan — QAO's Signature (Indicates NCR Complete)
2-7-12 — Date

Nonconformance Report

NCR #: 11-1308
Assigned by QAO

Part D: Corrective Action Request

Responsible Manager (Investigation, Root Cause, and Proposed Corrective Actions(s))

1) Description of Root Cause Investigation

See attached

2) Results of Root Cause Determination

See Attached.

3) Proposed Corrective Action(s) and Preventive Measures
(Include Responsible Individual and Estimated Completion Date for each action)

See attached sheets

Eugene Mullegan
Responsible Manager's Signature

2-7-12
Date

Attachment I

CAR 11-1308
LANL LLH3 Data

Description of Root Cause Investigation:

1) Existing and Prior Controlled spreadsheets used to calculate low level tritium activity were reviewed and evaluated to determine where the formula error occurred. This process determined that the error began in April 2010. All prior versions of spreadsheet did not contain the rounding function that has been in use since April 2010. In addition, existing spreadsheet was verified that all calculation cells were locked and password protected. Rounding error was not a result of inadvertent change.
2) Initially, all data from 2010 to 2011 was reviewed for typographical errors. All 13 columns of the spreadsheet where manual data entry occurs were reviewed against the raw data. This review was performed by Susan Leese of ARS. One error was found in 34 batches resulting in the incorrect reporting of 20 samples. This error occurred when the DPM values were entered into the average CPM column instead of the CPM values for the entire batch of samples. As a result of this finding, additional data from 2008 and 2009 was reviewed in the same manner. This review was conducted by Jimmy Turner of ARS and Lonnie Morris of AQA, each reviewing approximately 50% of the data. Typographical errors were found in 4 of 22 batches resulting in the incorrect reporting of 35 samples. These errors included incorrect activity reference dates and incorrect background values. None of these errors were caught during ARS's original review of data prior to release of final reports. In addition, more than 50% of the calculations were manually verified by Lonnie Morris of AQA and Susan Leese of ARS. No additional calculation errors were found, which confirmed that the spreadsheet in use prior to April 2010 was correct and did not contain any formulation errors.

Root Cause Investigation Results:

1) Spreadsheet placed in service in April 2010 by Tony Byrd contained an invalid formula in the average CPM column which caused the average CPM to round to the nearest whole number and thus calculate the results incorrectly. This error was isolated to this column of cells. All other formulas were correct.
2) Existing data review process for low level tritium does not include a 100 % review by a second person for manual data entry parameters. Since this process is manual there is high potential for human error. This process needs to be automated so that manual transcription errors do not occur.

Corrective Actions:

1)

A) Corrected existing spreadsheet to remove rounding formula from average CPM column so that calculation is performed correctly. Once completed, had an independent validator perform manual verification of all calculations. Once independent verification was completed, locked formula cells and password protected, and issued new spreadsheet for use. Also, previous version of spreadsheet was removed from use. Responsible Party: Virgene Mulligan, ARS, VP Laboratory Services. Independent Validator: Bob Shannon, Independent Contractor.

B) Recalculated all data from 2009 and 2010 using new spreadsheet and reported corrections on Form 1's to LANL. In addition, level IV data packages and EDD's will be revised and resubmitted to LANL by October 14, 2011. Responsible Party: Susan Leese, ARS, Project Manager.

C) Summarized before and after activities in a spreadsheet and submitted to LANL for review. Responsible Party: Susan Leese, ARS, Project Manager.

D) Program calculations and automate data reporting of Low Level Tritium analysis into TRAX Laboratory Information Management System so that a spreadsheet is no longer required. Once programmed, verify calculations are correct and release for use into the laboratory. Expected completion date is on or before March 31, 2012. Responsible Party: Virgene Mulligan, ARS, VP Laboratory Services and David Bowling, LIMS programmer.

2)

A) Compiled list of all low level tritium data for LANL from January 2008 thru March 2010 and submitted to Nita Patel and Lonnie Morris. Once compiled, list was split for review between Lonnie Morris and Jimmy Turner. All data was reviewed as stated above in the investigation, errors were corrected, and level IV data reports and EDD's were resubmitted to LANL. Responsible Party: Jimmy Turner, ARS, Laboratory Manager; Lonnie Morris, AQA; and Susan Leese, ARS, Project Manager.

B) See Item 1D above. Until completion of LIMS programming, data review procedure for manual data entry for Low Level Tritium will include a 100% review of all manually entered data by a second person. Manual review will be documented on printed spreadsheet by initials and date of person performing the review.