SAND2014-17903R

Summary Report for the Environmental Protection Agency MERL/FRMAC/RAP Mission Alignment Exercise held at the Savannah River Site on June 9-13, 2014

Project Name: Mission Alignment with EPA Mobile Laboratory and FRMAC Fly Away Laboratory

IAA #: HSFE90-13-X-0055

September 2014

Sandia National Laboratories
Operated for the U.S. Department of Energy by
Sandia Corporation
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Executive Summary

From June 9th thru June 13th 2014, members of the Federal Radiological Monitoring and Assessment Center (FRMAC), the Environmental Protection Agency (EPA) and the Department of Energy Radiological Assistance Program (DOE RAP) Region-3 participated in a joint nuclear incident emergency response exercise at the Savannah River Site (SRS) near Aiken, South Carolina. The purpose of this exercise was to strengthen the interoperability relationship between the FRMAC, RAP, and the EPA Mobile Environmental Radiation Laboratory (MERL) stationed in Montgomery, Alabama. The exercise was designed to allowed members of the DOE RAP Region-3 team to collect soil, water, vegetation and air samples from SRS and submit them through an established FRMAC hotline. Once received and processed through the hotline, FRMAC delivered the samples to the EPA MERL for sample preparation and laboratory radiological analysis. Upon completion of laboratory analysis, data was reviewed and submitted back to FRMAC via an electronic data deliverable (EDD). As part of the exercise, an evaluation was conducted to identify gaps and potential improvements in each step of the processes. Additionally, noteworthy practices and potential future areas of interoperability between FRMAC and EPA were acknowledged. The exercise also provided a unique opportunity for FRMAC personnel to observe EPA sample receipt and sample preparation processes and to gain familiarity with the MERL laboratory instrumentation and radiation detection capabilities. The observations and lessons-learned from this exercise will be critical for developing a more efficient, integrated response for future interactions between the FRMAC and EPA assets.

List of Acronyms

AAL- Analytical Action Level
AIS- Analysis Instruction Sheet
ARF- Analytical Request Form
DOE RAP- Department of Energy Radiological Assistance Program
EDD- Electronic Data Deliverable
EPA- Environmental Protection Agency
FAL- Fly Away Laboratory
FRMAC- Federal Radiological Monitoring and Assessment Center
GPC- Gas Proportional Counter
Lc- Critical Level
LCS- Laboratory Control Sample
MDA- Minimum Detectable Activity
MERL- Mobile Environmental Radiation Laboratory
MERL-AL- Mobile Environmental Radiation Laboratory stationed at Montgomery, Alabama
NAREL- National Analytical Radiation Environmental Laboratory
POC- Point of Contact
PPE-Personal Protective Equipment
QC- Quality Control
RDD- Radiological Dispersion Device
RAMS- Radiological Assessment and Management System
RTFL- Radiation Task Force Leader
SCF- Sample Control Form
SOP- Standard Operating Procedure
SNL- Sandia National Laboratories
SPL- Sample Preparation Laboratory
SRS- Savannah River Site

Introduction

The U.S. Department of Energy (DOE) and the Environmental Protection Agency (EPA) have independently developed mobile laboratory assets for use in high-priority sample analysis during a nuclear incident. The DOE Fly Away Laboratory (FAL) is composed of one gamma spectrometer, two alpha/beta counting systems and two liquid scintillation counters, all of which are portable and have the ability to be shipped via commercial airlines or DOE aircraft to the incident site. EPA has two mobile laboratory assets: one mobile radiation detection laboratory with accompanying sample preparation laboratory and command post, stationed in Las Vegas, NV; and one mobile radiation detection laboratory with accompanying sample preparation laboratory based in Montgomery, AL. During an emergency response, both EPA and DOE mobile laboratory assets would likely be deployed to the same location, with the FAL most likely arriving before the ground-transported EPA mobile laboratories. As such, coordination between the groups is not only desirable, but essential to a united, efficient response.

Recently, a unique opportunity has presented itself as the two EPA mobile laboratories are in the process of restructuring under common leadership in an effort to provide consistency between the two assets. This consistency between the two EPA mobile labs could also be expanded to the DOE FAL in many cases to create operating efficiencies. Since each of the DOE and EPA assets have strengths and shortfalls, collaboration between the labs could leverage the capabilities of each asset to create a more unified effort.

Since the two EPA MERLs differ in their equipment, personnel and capabilities, it was prudent for the FRMAC to conduct interoperability exercises with each EPA mobile lab so that unique strengths and weaknesses could be identified. This report summarizes the first of these interoperability drills, conducted between the FRMAC, the EPA MERL stationed at Montgomery, AL (MERL-AL) and the DOE RAP Region-3 team.

Objectives of the Interoperability Exercise

In an effort to practice interoperability, the following objectives were agreed upon by EPA, FRMAC and the RAP team prior to the exercise:

RAP Team Objectives:

- Deploy MPCD tablets
- Use tablets for sampling activities
- Perform proper packaging, handling and transport through sample receiving hotline

FRMAC Objectives:

- Receive and log in samples

- Walk down RAMS to verify that it is functional for emergency operations
- Create Analysis Request Forms
- Process samples through the on-site MERL-AL laboratory
- Obtain data results back from MERL-AL, validate results and upload into RAMS
- Identify efficiencies and interoperability areas between FRMAC and EPA

EPA Objectives:

- Deliver MERL-AL and sample preparation laboratory to SRS
- Set up MERL-AL and sample preparation laboratory
- Connect with National Analytical Radiation Environmental Laboratory (NAREL) for data backup
- Train and begin qualification and documentation process for MERL and sample preparation lab operators, including Radiation Task Force Leaders (RTFLs)
- Provide EDD to FRMAC Laboratory Analysis
- Compare spiked sample results to known values

Description of the Interoperability Exercise

Historically, exercises have focused on processes that occur during the first few days of an event, which include sampling and monitoring, taking field measurements, and submitting samples for laboratory analysis. Due to time constraints, exercises typically do not progress to the latter-stage processes that involve sample analysis and evaluation of data/results. Many of these processes are analytically complex, including data transfer from laboratories to the FRMAC, data quality evaluation, and the assessment of radiological sample results. While many of these processes have been developed and integrated into existing tools, many of them have not been tested in a functional exercise. To avoid this potential shortcoming, an event was created in RAMS prior to the start of the exercise and populated with Sample Control Forms (SCFs) corresponding to soil, vegetation and air filter samples that were pre-collected and pre-labeled. In all, 23 soils were pre-staged, 15 of which were spiked with Cs-137 to activity levels ranging from 8.18—29.9 pCi/gram (Appendix 1). Seven vegetation samples, six air filters and three water samples were also pre-prepared. A mixture was created in RAMS using Cs-137 as the radionuclide of interest and Analytical Action Levels (AALs) were subsequently derived for inclusion on Analysis Request Forms (ARFs). ARFs were also pre-staged in RAMS to allow for immediate delivery of samples to MERL-AL at the start of the exercise.

On June 9, 2014, members of the Federal Radiological Monitoring and Assessment Center (FRMAC), the Environmental Protection Agency (EPA) and the Department of Energy Radiological Assistance Program (DOE RAP) Region-3 arrived at the Savannah River Site (SRS) near Aiken, South Carolina to participate in a joint nuclear incident emergency response exercise. The EPA MERL-AL and Sample Preparation Laboratory (SPL) trailers were deployed from their home base in Montgomery, Alabama and delivered to the exercise site. On the morning of June 9th, the MERL-AL and SPL were transported to a staging area in a parking lot at SRS, next to the FRMAC sample control hotline. Upon arrival, EPA personnel proceeded to set up a sample receiving area outside of the SPL per the "NAREL Standard Operating

Procedure for Sample Preparation and Receipt (MERL)." EPA personnel simultaneously set up the radiation detection instrumentation in the MERL-AL and conducted quality control measurements in preparation for sample counting operations that were planned for the following day. RTFLs and visiting EPA-Las Vegas MERL staff also successfully observed and assisted in the MERL and SPL set up operations as part of an EPA training initiative.

The following morning (June 10, 2014), a pre-exercise safety and information briefing was conducted for all EPA, FRMAC and RAP team members. A scenario was described by the controller that a Radiological Dispersion Device (RDD) was denoted on the site along with 30 pounds of explosives. He informed everyone that 36 samples had already been collected (i.e. the pre-staged samples) and were ready to be delivered to the MERL-AL for analysis. Additional soil, water, vegetation and air samples were to be collected by the RAP team over the next 2 days as part of their 10-point sampling plan.

Over the next two days, the RAP teams collected a total of 3 water, 6 vegetation, 8 soils and 27 air filter samples from across the site and successfully delivered them to the FRMAC sample control hotline. As they arrived at the hotline, samples were logged into RAMS by FRMAC sample control specialists, organized onto ARFs and delivered to the EPA sample receipt line. Samples were received by EPA sample control specialists where they were inspected, characterized for dose rate, surveyed for external contamination, logged into MERL's internal sample tracking system and routed to the Sample Preparation Specialists in the SPL. Samples were then re-packaged (if necessary) into appropriate counting geometries for analysis by either gamma spectroscopy or gas proportional counting. After samples were appropriately prepared, they were once again surveyed for external contamination and then transferred to the MERL-AL for analysis by the method requested on the ARF.

In total, nine ARFs were sent to the MERL-AL, consisting of various environmental samples. By the end of the exercise, MERL-AL processed, counted and output analytical results for 26 air filters, 5 water samples, 27 soils and 10 vegetation samples. Nine of the air samples were characterized by both gamma spectroscopy and gross alpha/beta counting. The remaining air, water, soil and vegetation samples were all analyzed by gamma spectroscopy only. A summary of the samples that were submitted by FRMAC to MERL-AL and were counted during the exercise are included in Appendix 2. These samples include both pre-staged samples and samples collected by the RAP teams during the exercise.

After samples were counted, reports of results were reviewed by the appropriate instrument analyst(s) and the designated EPA Quality Control Specialist. Approved data results were then entered into an electronic data deliverable (EDD) format and delivered to FRMAC staff via portable memory devices. EDDs were then reviewed by FRMAC Quality Control Specialists and entered into the RAMS database. By the time the exercise had ended, four of the nine submitted EDDs had passed through the entire FRMAC Quality Control (QC) process. The remaining five submitted EDDs have yet to be reviewed by FRMAC Quality Control Specialists, but will be evaluated at a later date.

Following the conclusion of the exercise, two separate hotwashes were conducted to discuss lessons-learned among the participants. The first hotwash was held specifically for the RAP teams, while the second focused on the interactions between FRMAC and the EPA MERL-AL. For the purposes of this report, only the items that were discussed in the second hotwash will be addressed here. Process improvements and potential areas for interoperability that were discussed in the second hotwash are captured in the subsequent sections of this report.

Evaluation of Exercise

During the exercise, FRMAC/SNL personnel had the opportunity to act as outside observers to EPA's sample receipt, preparation and counting processes as well as evaluate the effectiveness of established FRMAC processes. These observations were compiled and shared at the hotwash following the conclusion of the exercise. The observations were categorized according to the following functional areas:

- sample receipt
- sample preparation
- logistics
- conduct of operations
- waste management
- sample analysis, and
- reporting/Electronic Data Deliverable (EDD).

In total, 21 potential process improvements were noted for FRMAC operations, along with one noteworthy practice. For MERL-AL and SPL operations, 20 process improvements were identified, as well as 10 noteworthy practices. Appendix 3 captures all of the observations noted in each functional category and groups items according to recommended process improvements and noteworthy practices.

The exercise proved to be largely successful, evidenced by the fact that nearly all of the pre-determined FRMAC and EPA drill objectives were met within the 4-day exercise period. Most of the major FRMAC and MERL-AL laboratory operational processes were successfully walked down during the exercise. In contrast to most other interagency drills, this exercise was successful in testing many of the "backend" processes (i.e. QC of analytical results, uploading results into RAMS, etc.) that typically are not tested in drills due to time constraints. Pre-staging of samples and allowing for one full day of time to set up the MERL and the SPL proved to be crucial steps in ensuring the success of the exercise.

Opportunities for Interoperability in Future Work

One of the goals of this joint exercise was to evaluate areas of interoperability between FRMAC and EPA. The following areas were identified as potential opportunities for future interoperability and areas where goals can be aligned between FRMAC and EPA MERL to provide for a more efficient, unified response:

- Exploring the possibility of a common color code scheme on paperwork that conveys urgency of sample turnaround time.
- A formalized agreement should be drafted to spell out who is accountable for waste disposal of PPE, sample preparation waste, contaminated containers, etc. from the on-site mobile laboratories.
- The SPL is only able to perform limited mixing of samples (i.e. soils) or repackaging into different containers. A document that identifies what types of samples FRMAC should send to the SPL in light of its recognized capabilities and limitations should be explored. To be effective, this document would need to be reviewed periodically to match changes in SPL procedures and capabilities.
- During the exercise, it became apparent that it was difficult to consistently identify the active side of an air filter with 100% confidence, especially when there was little residue on the active side of the filter. A process to identify the active side of air filters should be agreed upon between the two groups and FRMAC Monitoring and Sampling field collection teams.
- A positive outcome of the exercise was an observed sharing of equipment (i.e. balances, printers, internet connections, etc.) between MERL-AL and FRMAC. A Memorandum of Understanding (MOU) may be useful to solidify expectations of resource sharing between the two groups and to identify areas where either organization can serve as a surrogate to the other for specified items.
- As part of the exercise, the MERL-AL requested that a Project Acceptance Form be completed by FRMAC as a means to provide EPA with FRMAC POC information as well as general sample information such as types and quantities of samples expected, suspected analytical methods that would be requested and radionuclides that would be of interest. In this manner, customer (FRMAC) expectations were made clear to MERL-AL prior to the start of an event and the MERL-AL was able to anticipate equipment and personnel requirements. This experience illustrated that there is additional opportunity for FRMAC and EPA to develop methods for communicating expectations prior to deployment of resources.
- The formation of a Field Operation Workgroup that meets semi-annually at alternating facilities (i.e. Montgomery, AL and Las Vegas, NV) would be useful for addressing common issues encountered by both EPA MERLs, the FRMAC Lab Analysis group, and the FRMAC Fly Away Laboratory.

Conclusions

The joint exercise at Savannah River provided a unique opportunity for FRMAC personnel to work side-by-side with MERL-AL personnel and to work through many of processes that have not been exercised in other drills. In addition, this exercise allowed FRMAC to observe EPA sample receipt and sample preparation processes and to gain familiarity with the MERL laboratory instrumentation and radiation detection capabilities. The observations and lessons-learned from this exercise will be critical for developing a more efficient, integrated response for future interactions between the FRMAC and EPA assets.

Appendix 1. List of Pre-staged Blank and Spiked Samples and Associated Levels of Activity.

RAP Sample #	Sample Type	Status	Activity	Date Collected	FRMAC Barcode ID
FM2B-7	Soil	Spiked	29.9 pCi/gm	6/9/2014	SCF-02401
CS-1	Soil	Clean	N/A	6/9/2014	SCF-02402
CS-2	Vegetation	Clean	N/A	6/9/2014	SCF-02403
CS-3	Air	Clean	N/A	6/9/2014	SCF-02404
F08-11	Soil	Spiked	28.1 pCi/gm	6/9/2014	SCF-02405
CS-4	Soil	Clean	N/A	6/9/2014	SCF-02406
CS-5	Vegetation	Clean	N/A	6/9/2014	SCF-02407
CS-6	Air	Clean	N/A	6/9/2014	SCF-02408
FM2B-6	Soil	Spiked	27.6 pCi/gm	6/9/2014	SCF-02409
CS-7	Soil	Clean	N/A	6/9/2014	SCF-02410
CS-8	Vegetation	Clean	N/A	6/9/2014	SCF-02411
CS-9	Air	Clean	N/A	6/9/2014	SCF-02412
FM2B-9	Soil	Spiked	26 pCi/gm	6/9/2014	SCF-02413
CS-10	Soil	Clean	N/A	6/9/2014	SCF-02414
CS-11	Vegetation	Clean	N/A	6/9/2014	SCF-02415
CS-12	Air	Clean	N/A	6/9/2014	SCF-02416
FM2B-14	Soil	Spiked	23.9 pCi/gm	6/9/2014	SCF-02417
CS-13	Soil	Clean	N/A	6/9/2014	SCF-02418
CS-14	Vegetation	Clean	N/A	6/9/2014	SCF-02419
CS-15	Air	Clean	N/A	6/9/2014	SCF-02420
CS-16	Soil	Clean	N/A	6/9/2014	SCF-02421
CS-17	Vegetation	Clean	N/A	6/9/2014	SCF-02422
CS-18	Air	Clean	N/A	6/9/2014	SCF-02423
CS-19	Soil	Clean	N/A	6/9/2014	SCF-02424
CS-20	Vegetation	Clean	N/A	6/9/2014	SCF-02425
FM2B-11	Soil	Spiked	29.9 pCi/gm	6/9/2014	SCF-02426
FM2B-12	Soil	Spiked	28.4 pCi/gm	6/9/2014	SCF-02427
FM2B-13	Soil	Spiked	26.4 pCi/gm	6/9/2014	SCF-02428
F08-6	Soil	Spiked	23.5 pCi/gm	6/9/2014	SCF-02429
FM2B-8	Soil	Spiked	21.9 pCi/gm	6/9/2014	SCF-02430
F08-10	Soil	Spiked	27.5 pCi/gm	6/9/2014	SCF-02431
F08-5	Soil	Spiked	24 pCi/gm	6/9/2014	SCF-02432
F08-12	Soil	Spiked	23.7 pCi/gm	6/9/2014	SCF-02433
FM2B-10	Soil	Spiked	29.6 pCi/gm	6/9/2014	SCF-02434
F08-3	Soil	Spiked	8.18 pCi/gm	6/9/2014	SCF-02504

Appendix 2. Summary of ARFs and samples submitted to and counted by MERL-AL during the exercise.

ARF Number	Sample Quantity/Type	Analysis Requested
ARF-00001	6 Air Filters	Gross alpha/beta by GPC; Cs-137 by gamma spec
ARF-00002	3 Waters	Cs-137 by gamma spec
ARF-00003	7 Vegetation	Cs-137 by gamma spec
ARF-00004	11 Soils	Cs-137 by gamma spec
ARF-00005	12 Soils	Cs-137 by gamma spec
ARF-00006	1 Vegetation 1 Soil 1 Air Filter	Cs-137 by gamma spec Cs-137 by gamma spec Gross alpha/beta by GPC; Cs-137 by gamma spec
ARF-00007	19 Air Filters	Gross alpha/beta by GPC
ARF-00008	2 Vegetation 2 Soils 2 Waters	Cs-137 by gamma spec Cs-137 by gamma spec Gross alpha/beta by GPC; Cs-137 by gamma spec
ARF-00009	1 Soil	Cs-137 by gamma spec

Appendix 3. Description of observations, recommended process improvements and noteworthy practices for FRMAC and MERL-AL operations according to functional categories.

Sample Receipt

Process Improvements (FRMAC):

- Need to update the Analysis Instruction Sheet (AIS) to indicate that the laboratory needs to report and identify all gamma peaks of significance even if they are not specified in the ARF.
- Need to add the ARF number to the AIS.
- Information on the result flags need to be updated on AIS.
- Need to fix wording in sample batch section with regards to the number of batches that can be accepted on one ARF/EDD.
- Need to rethink how special instructions are conveyed on the AIS to the laboratories. Currently, special instructions are often ignored by receiving labs because there is so much other standard informational text on the AIS that masks the special instructions.
- Although FAL was not deployed to exercise, it was noted that the FAL should consider adopting some of the EPA's sample receipt processes.

Process Improvements (EPA):

- Overall sample receipt process was time consuming. Efficiencies could be gained by moving from a paper-based system to an electronic LIMS system.

Noteworthy Practices (EPA):

- Sample receipt process is very well documented.
- A Field Monitoring Log was used to record background measurements.

Sample Preparation

Process Improvements (FRMAC):

- The FRMAC should consider adding a section to the ARF or AIS that indicates special sample preparation instructions.

Process Improvements (EPA):

- Contamination control processes need to be revisited. The following observations were made during the sample preparation process:
    - Once a sample has been transferred into a new container, an alcohol wipe is used to clean the container prior to taking a dose rate measurement on the sample and swiping the container for external contamination. Although this is a notable practice, the alcohol wipe is placed on a clean surface after use and is used for multiple samples,

resulting in the potential for cross-contamination. It is recommended that the alcohol wipe only be used for one sample container and segregated as "potential radioactive waste" until analytical results are obtained.

- One plastic liner is used for an entire batch of samples resulting in potential cross contamination of samples in the fume hood.
- Personnel were performing "clean" operations (i.e. recording data) while wearing gloves, which could cause un-wanted perception issues.
- A spill occurred while transferring a water sample to a 1-L marinelli beaker, resulting in potential SPL contamination.
- Gloves were not changed between samples during preparation.
- At sample receipt, the surfaces of the swipe samples taken for external contamination were being touched by the paper cover when moving them around on the table.

Logistics

Process Improvements (FRMAC):

- Balance and printers need to be replaced at sample hotline with ruggedized units. These items were borrowed from the EPA MERL during the exercise to support FRMAC operations.
- FRMAC Initial Laboratory Questionnaire is not consistent with Laboratory Analysis Manual.
- FRMAC needs to include the barcode manuals in the sample control hotline load out boxes.
- Personnel should consider wearing apparel that contains identifiable FRMAC roles.

Process Improvements (EPA):

- During the exercise, non-standard 60 mm air filters were submitted by the RAP teams which were not discovered until the samples were being prepared in the SPL. EPA should consider keeping a 47mm air filter punch in the SPL to accommodate non-standard filter media that is submitted.

Conduct of Operations

Process Improvements (FRMAC):

- FRMAC should consider specifying a count time range (i.e. 10-100 minutes) for its detectors in the Fly Away Laboratory Manual, similar to what EPA prescribes in their Standard Operating Procedures (SOPs).
- Samples should be submitted by FRMAC in batches consisting of similar matrices and no more than 20 samples in a batch. Batches containing small quantities of similar matrices should also be avoided (if possible) to reduce batch QC requirements.

Noteworthy Practices (FRMAC):

- The number of pre-staged samples combined with the flow of samples from the field was adequate and allowed EPA to meet their objectives.

Process Improvements (EPA):

- Should consider using manila folders to organize paper work as it flows between internal operations.
- There was inconsistency regarding if and when the Analysis Instruction Sheet (AIS) was being read. In some cases, the AIS was not read until after the sample was prepared and received by the MERL-AL for counting.
- MERL and SPL leadership did not have a presence outside of their respective trailers. Should consider appointing a team leader to coordinate activities between the two trailers as well as interactions with FRMAC and customers.
- Evaluate process of transferring samples internally from person to person within EPA MERL.
- A soil sample provided to FRMAC was reclassified by EPA as a vegetation sample due to an observed low density. This was done to more closely match the calibrated geometry of the gamma spectrometer. Although noteworthy, once the sample was moved to another batch (i.e. vegetation matrices), a copy of the original ARF did not accompany the sample which caused confusion when the results were reported. In this case, the vegetation batch should have contained a copy of the AIS and ARF from the soil and vegetation batches.

Noteworthy Practices (EPA):

- Radiation Task Force Leaders (RTFLs) trained personnel were utilized by EPA to supplement its sample receipt and sample preparation operations.
- MERL-AL was flexible in its batching process to allow for multiple samples (of the same matrix type) to be batched together, even though they arrived on separate ARFs. Conversely, MERL-AL was able to coordinate analysis of one sample by three different requested methods of analysis.
- QC samples were logged in as a separate batch number to allow similar matrices to be combined into a common QC batch.
- Color coding was used on paperwork to convey urgency of samples.

Waste Management

Process Improvements (EPA):

- Should consider segregating waste to minimize the volume of radioactive waste produced. For example, PPE waste could be labeled with a batch number and set aside until analytical results are obtained. Waste could then be assessed as radioactive or non-radioactive waste and disposed of accordingly.
- Consider implementing a waste addition log to track volume and activity of waste

Sample Analysis

Process Improvements (EPA):

- Procedure AM/SOP-23 (page 5/47) is inconsistent with the energy calibration QC tolerance of ±0.5 keV.
- If soil purchased locally is to be used as a matrix blank, it should be characterized prior to use.
- For gamma spectroscopy, the recommendation is to re-establish the QC background chart at each new location due to dynamic background conditions.
- For air filters of different sizes (i.e. 2" and 4") that were analyzed on the GPC in the same batch, it was not clear in the exercise whether or not separate Lab Control Samples (LCS) needed to be included for both sizes since they are counted using two different calibrated geometries. It is recommended that the batch QC requirements be reviewed in this regard.

Noteworthy Practices (EPA):

- Customized gamma spectroscopy library was built during the exercise.
- Soil was purchased from a nearby hardware store to use as a matrix blank for gamma spectrometer analysis.

Reporting/Electronic Data Deliverable (EDD)

Process Improvements (FRMAC):

- Need to make improvements to the EDD Description File as follows:
    - Need to update the Sample# description to make it very clear that MERL-AL (or any other lab) is to create their own unique identifier for any internal lab QC samples.
    - Need to be more specific on allowable character types.
    - Need to show examples of activity concentrations. Currently, the examples only show gross activities, which can be confusing. The example table should also be updated.
    - Clarify the "A" flag vs. the "null" field. The EDD description does not list the null field. The AIS includes null but not "A". Improvements to the data flagging process altogether are needed.
    - The examples do not match the required syntax for fields like result type and analysis method.

- Need to update the Bulk Sample Result Upload Template as follows:
    - Need to expand columns on the template file so that there are no text overflows.
    - Need to make description of %Recovery field clearer since laboratories will want to put in tracer recovery and not LCS Recovery as intended.
    - Drop-Down lists in some of the EDD fields would make initial data entry less-confusing.

- Need to update the Analysis Instruction Sheet as follows:

    - Clarify the “A” flag vs. the “null” field. The EDD description does not list the null field. The AIS includes null but not “A”
    - Need to add a detailed description on how to report duplicate results as this is unclear in the paperwork.
- Need to update contact information in RAMS for the EPA mobile lab.
- EDD uploader in RAMS does not read in recoveries as a percentage (XX.XX%) though the template format defaults to this. The values must be entered in as a fraction (i.e. 0.98 for 95%). Therefore, either the upload or the template files need to be fixed.
- The appropriate conversions are not being made when laboratories report either the Lc or the MDA and not both.
- The verification qualifier (ver qual) is very cumbersome to change; consider using a similar approach to the validation qualifier (val qual) field.
- The sample batching requirements driven by the RAMS QA engine was confusing and difficult for the EPA to work with. FRMAC should consider revising the QA process in RAMS to accommodate more flexibility.

Process Improvements (EPA):

- Recommendation to include count time, level of uncertainty and Sample Control Form (SCF) customer number on Gas Proportional Counter (GPC) reports.
- Critical level and Percent Recovery should be stated on GPC and gamma spectroscopy reports.
- Gamma spectroscopy and GPC reports initially did not have approval signatures. Although this was resolved at the exercise, it is recommended to train QC officers to review final reports for completeness.
- Duplicate samples did not reference customer sample IDs on gamma reports which led to difficulties in reviewing the data by FRMAC Quality Control Specialists. Recommendation to include customer sample ID as identifying feature on duplicate sample reports.
- Case narratives should be included with samples where abnormalities are encountered.
- Need to re-format the ARF number column on the EDD to include only the number (as opposed to the entire ARF-000#).

Noteworthy Practices (EPA):

- A Z-score is tabulated for duplicate samples as a standard QC practice.
- GPC is calibrated for efficiency using a Mylar encased source for conservatism and to account for potential alpha attenuation in air filters.