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Summary of Observations from the 2017 Federal Radiological Monitoring and Assessment Center (FRMAC) Laboratory Analysis Training and Capstone Event

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Introduction

On August 15th thru 17th, 2017 the Federal Radiological Monitoring and Assessment Center (FRMAC) Laboratory Analysis division, the FRMAC Fly Away Laboratory (FAL), the FRMAC Assessment division, and the Mobile Environmental Response Laboratory (MERL) held a training and capstone event for staff from the Environmental Protection Agency (EPA), Remote Sensing Laboratory (RSL), Lawrence Livermore National Laboratory (LLNL), and Sandia National Laboratories (SNL). LAB-100, "Sample Control Training", LAB-200 "QA Specialist Training", and LAB-300 "Laboratory Analysis Manager Training" was given the first two days of the event. The purpose of the training and capstone event was to meet training requirements for billeted FRMAC Lab Analysis staff from RSL, LLNL, and SNL as well as raise awareness of the FRMAC Lab Analysis process with EPA staff as part of a Federal Emergency Management Agency – Nuclear Incident Response Team (FEMA-NIRT) laboratory standardization project. An objective of the standardization project was to help improve the transition of operations from DOE to EPA during a response. To do this effectively, detailed knowledge of the FRMAC Lab Analysis process by the EPA is needed. This training provided a good opportunity for this knowledge transfer.

A capstone was held after the two-day training event to allow participants to practice the skills they learned in a realistic scenario. A scenario that was previously developed for a quarterly Consequence Management drill (i.e. Dark Phoenix) was used as the basis for the capstone, with laboratory analysis focused injects used to drive the exercise play. Each position within the FRMAC Lab Analysis Division exercised to specific objectives and helped to uncover gaps in the established processes. The lessons learned during this capstone are broken out in the following categories: Sample Control, In-Situ Gamma Spectroscopy, Analysis Request Forms (ARF), Shipping, QA/QC, Fly Away Laboratory (FAL), and Management.

Objectives of the Capstone Exercise

Position-specific objectives were written for the capstone by the FRMAC Lab Analysis Working Group to ensure that each position had the opportunity to exercise their primary function in a response. In addition to the DOE participants, the EPA participants had a special objective. These objectives are listed below.

Laboratory Analysis Manager:

- Coordinate efforts between the FRMAC divisions
- Communicate mission objectives to Deputy Lab Manager

Deputy Laboratory Manager:

- Manage RAMS mixtures
- Activate laboratories in RAMS
- Manage field operations

Sample Control:

- Log Samples into RAMS
- Create Analysis Request Forms (ARFs)

Shipping Specialist:

- Package and ship samples for analysis to the Environmental Protection Agency – Mobile Emergency Response Laboratory (EPA-MERL)

QA Specialist:

- Review laboratory data packages
- Import data from Web Portal
- Perform QA review in RAMS

Gamma Spectroscopist:

- Process in-situ spectra and report results in RAMS

Fly-Away Lab (FAL) Manager/Analyst:

- Process samples through FAL

EPA objectives

- Shadow key FRMAC Lab Analysis positions during the capstone to obtain operational knowledge that will assist in the transition of operations from DOE to EPA in the latter phases of an incident.

Description of the Capstone Exercise

The scenario for this capstone was built upon pre-existing material that was used during the Dark Phoenix quarterly drills carried out in FY17. The scenario involved the release of Cs-137 and a pure beta emitter (P-32) delivered via radiological dispersal device (RDD) in Northern Las Vegas. A few key missions were described in the scenario including the survey and clearance of the Highway 95 corridor, the survey and clearance of an affected food orchard, and the survey and clearance of a nearby neighborhood. These missions were chosen to drive sample collection and laboratory analysis activities. Pre-planned injects included simulated samples, in-situ gamma spectra and analytical results that were revealed to players throughout the capstone in order to steer them to toward completing the exercise objectives.

Injects for the capstone included 30 simulated samples of various matrices with pre-populated sample control forms (SCFs) and 10 pre-populated sample results records and for the purpose of exercising quality assurance/quality control (QA/QC) review. In addition, nine simulated in-situ spectra collected from the affected zone were placed in RAMS for evaluation by the Gamma Spectroscopist, a new process that was being walked down for the first time during this capstone.

Evaluation of Capstone Exercise

Observations made during this capstone are categorized by functional area. The categories are: Sample Control, In-Situ Gamma Spectroscopy, Analysis Request Forms (ARF), Shipping, QA/QC, Fly Away Laboratory (FAL), and Management. A description of the observations are listed in the following sections.

Sample Control

- Manual entries are difficult when the SCF forms do not match the RAMS user interface (UI). Currently, some of the formatting on the SCF forms creates confusion for the user. For example, the checkboxes for air filters are offset and users may not know which box to check.
- SCF forms and tablets are not flexible enough to accomplish required tasks. The SCF's do not easily allow for change control or quick adaptations to scenarios and shifts in processes.
- The number of comment fields on the sample control form led to some confusion.
- The subtleties between Vegetation - Soil - Ground Deposition - Soil Core samples led to some confusion. Need a clear tie between sample type and why it is being collected and a clear way to communicate this on the sample metadata.
- There were no physical samples employed in this capstone and so it was difficult to visualize what was described on a sample control form. Having physical samples labeled and placed with the SCF's would improve realism in future drills.
- There is no field on the sample control form for swipes to indicate what was swiped. This information may be important to data users.
- No field on the sample control form is available to indicate a volume of water collected, though it does exist in RAMS and on the tablets.
- Noteworthy Practice: Nonconformance forms (NCFs) worked well during the exercises. Several different injects drove very good questions on the NCFs that were resolved with the simulated field teams.

In-Situ Gamma Spectroscopy:

- In order to attach results and spectra in RAMS there had to be an existing sample and ARF associated with the sample. This added unnecessary work to the gamma Spectroscopist.
- There is currently no process or procedure in place for evaluating in-situ gamma spectra.
- RAMS does not currently contain all the information required to process an in-situ spectrum. Currently, there is no place in RAMS to store the raw data, the calibration data for the instrument, any field notes/pictures, as well as the background spectra.
- There is currently no independent QA of gamma spectrometer settings and specifications used to collect data recorded in RAMS. It is suggested to include a

secondary review of the data as well as the instrument setup, configuration, and calibration information and documentation of such beside the data in RAMS.

- There is no process or defined requirements for secondary review of spectroscopic data.
- Noteworthy Practice: Detailed notes were taken by the gamma spectroscopist on how the process should look in the future.

Analysis Request Forms (ARF):

- Comments are not printed out in a conspicuous place on the ARF report. Comments need to be more clearly indicated on the ARF report.
- The way the sample volume is displayed on the ARF is confusing to some users.

Quality Assurance (QA):

- There is currently no ability for the FAL to automatically generate an Electronic Data Deliverable (EDD). This slows down data reporting a great deal.
- The current process of mixture creation does not require a secondary review. This is a tedious hand-entry process and prone to human error.
- Currently, there are no QA requirements to monitor front end processes such as the creation of sample control forms and ARFs. Mistakes made on sample entry and/or ARF creation will cause data concerns in the future.
- Analysts did not find it useful to enter Lab Control Sample (LCS) data in RAMS. Analysts felt that the Lab Control Sample data could simply be reviewed on the report provided. The LCS sample results were still loaded into RAMS, but only for the purpose to mark them as valid.
- Noteworthy Practice: The Job aids were helpful in working through the processes.

Shipping:

- Shipping specialists were not engaged at the beginning of the capstone because samples were not on ARFs and ready to ship. It was suggested that pre-staged samples and ARFs should be ready to process for shipping at the beginning of the capstone to allow them to exercise shipping processes.
- The paper-based organizational structure or system to organize and keep paperwork for the shipments was insufficient. There is the need for a checklist of paperwork that must be kept for a shipment. There must be a plan to convert paper records to electronic records after an event.
- There is currently no formal list of default analysis requirements for shipment parcels. A standardized checklist based on CFR173.436 shipping limits is needed to help shippers more efficiently determine what analyses are needed.

- There was an observation that if all interior containers in a shipment have been surveyed, then the outside box does not need to be surveyed. The external parcel survey may not be necessary if the item meets this criterion.

Fly Away Laboratory (FAL):

- There was not enough upfront communication between FAL and shippers to determine appropriate count times for parcel characterizations. Also, there is no tool to carry out the calculations given a source term.
- Currently, the FAL creates counting efficiency models for calibration on the fly for shipments since they are non-standard geometries, even though many shipping containers have standard dimensions. The process would be improved with the creation of pre-made calibration models for standard shipping containers.
- The process of how the FAL will process shipping surveys, how they are tracked, prioritized, and what are the reporting requirements are is not well-defined and may not be the same as for normal samples.
- Noteworthy Practice: The FAL was used to characterize parcels for shipment for the first time.

Management:

- There were difficulties in easily determining feasible laboratory detection limits and count times for different matrices. Need an improved ability to estimate detection limits for different matrices given AALs.
- The current method for converting DRLs to AALs is clumsy and prone to errors. There is no automated way to perform the conversion and it is done largely by hand.
- It was noted that labs may not be very well prepared to handle something as exotic as a P-32 source term for ground deposition samples. May consider reaching back to the Integrated Consortium of Laboratory Networks (ICLN) to determine the number of laboratories equipped to analyze P-32 with a radiological component.
- There is no structure in RAMS to allow a sample to be analyzed multiple times (i.e. for positive verification of a radionuclide by measuring its radioactive decay). It was suggested that this is an important analysis and should be defined and implemented in our processes.
- Development of a weathering factor relies on data that is not decay corrected (i.e. reported at the time of analysis). Currently, data must be manually decay corrected to moments in time other than the sample collection date/time. The standard practice of requiring laboratories to decay correct results to the collection date/time may make these types of analysis difficult since the time of analysis is not reported.
- In was noted that the Home Team Lab Analysis Manager needs to be very experienced with laboratory processes and have an ability to effectively communicate with the offsite lab POCs.

- An effective operational change would be to have individual Lab Analysis personnel (i.e. QA Specialists, Deputy Lab Managers, HT Lab personnel) dedicated to specific labs that are supporting the response to maintain working relationship and continuity between the two entities.

Conclusions

The capstone exercise was carried out by 15 DOE national laboratory and 7 USEPA NAREL personnel playing all roles of FRMAC Lab Analysis including the Fly Away Laboratory. The purpose of this capstone was to allow these participants to practice the skills they learned in training in a realistic scenario. The entire Lab Analysis process was exercised during this capstone as well as two new, never-before-exercised processes: the analysis and upload of in-situ gamma spectroscopy data and the analysis of shipment parcels by the Fly Away Laboratory. All objectives stated for this capstone were met.

Another purpose for this capstone was to allow our USEPA NAREL partners to shadow FRMAC Lab Analysis operations and learn how sample control is carried out during a response by DOE. This will hopefully help in the transition of operations from a DOE-led FRMAC to an EPA-led FRMAC in the latter-stages of a response. This fulfilled an important objective in the Lab Analysis Standardization FEMA-NIRT project.

This capstone exercise proved to be very valuable in uncovering gaps in the current FRMAC Laboratory Analysis process and in providing experience to Lab Analysis personnel in both DOE and EPA organizations. The observations and recommendations listed in this report will be added to the running list of items maintained by the FRMAC Lab Analysis Working group. This list is used by the working group to drive future program development efforts, strategy discussions, and proposal writing.