An Overview on Radioanalytical Methods and Lessons Learned During the ICLN Radiological Confidence Building Competency Test (CBCT) Full Scale Exercise

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Outline

- FDA's goals and objectives in participation of CBCT exercise
- Scope and scale of FDA's participation
- Considerations in test sample preparation
- Methods and resources applied for CBCT exercise
- Analytical results and data reporting
- Observations and discussions
- Key constrains and proposed action items

FDA's Goals and Objectives in Participation of CBCT Exercise

- Assess FDA's Food Emergency Response Network (FERN) ability to respond radiological events involving alpha and beta radioactivity
  - Dissemination of samples and related information
  - Existing methods and their applicability for screening and confirmatory analysis
  - Sample surge capacity and turnaround time
  - Data acceptance criteria, management, and interpretation
- Evaluate interoperability between FDA FERN and Integrated Consortium of Laboratory Networks (ICLN)
  - Protocol for requesting additional resources and sharing analytical information
  - Adaptability to perform external network methods
  - Key elements in data reporting for mutual acceptance and comparability
- Identify intra- and inter-network needs and areas for improvement
  - MDVP priority, collaboration, and guideline
  - Multi-agency network data management
  - Communication and information exchange
  - Technical trainings and laboratory proficiency

Scope and Scale of FDA's Participation

Exercise Scenario and Timeline

1st RDD Explosion 05-12-14

2nd RDD Explosion 05-12-14

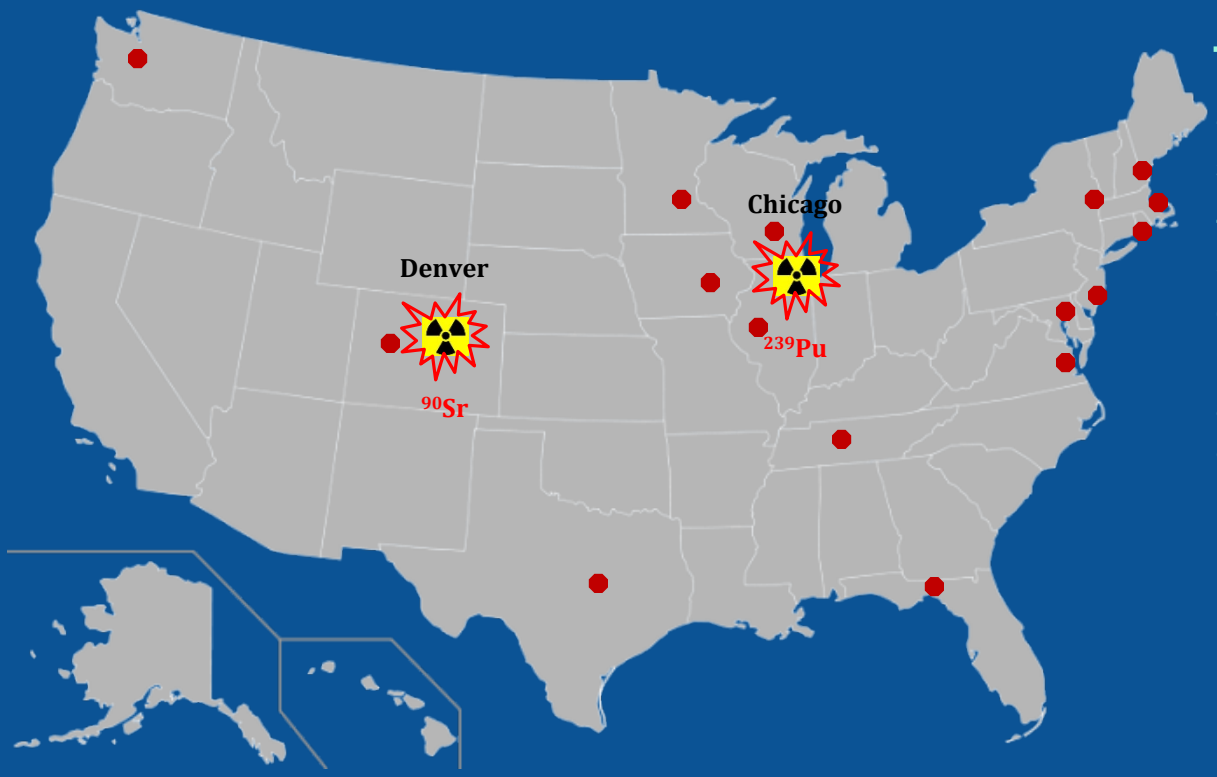
Start early-phase sample analysis 05-12-14

Received 1st set of screening results 05-13-14

Start recovery-phase sample analysis 05-14-14

Received 1st set of isotopic results 05-15-14

End of Exercise 05-19-14



Responding FDA/FERN Rad Labs

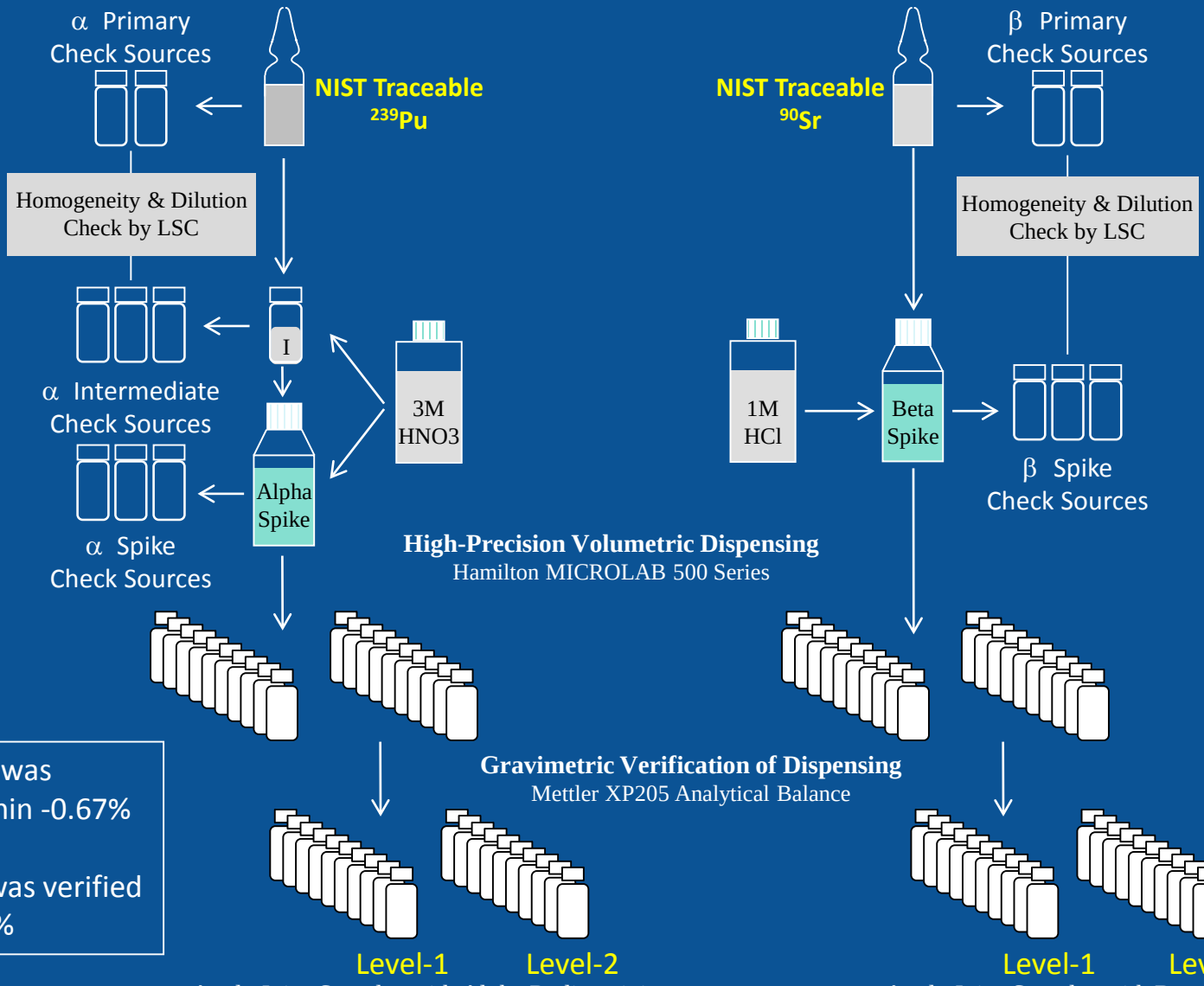
1. Maryland Dept. of Health and Mental Hygiene
2. Virginia Division of Consolidated Laboratory Services
3. Wisconsin State Laboratory of Hygiene
4. New York State Dept. of Health
5. Washington State Dept. of Public Health Laboratories
6. Colorado Dept. of Public Health and Environment
7. Winchester Engineering and Analytical Center
8. Texas Dept. of State Health Services Laboratory
9. Illinois Emergency Management Agency
10. University of Iowa Hygienic Laboratory
11. Tennessee Dept. of Health
12. Minnesota Dept. of Health
13. New Jersey Dept. of Health and Senior Services
14. New Hampshire Public Health Laboratories
15. Florida Dept. of Health Bureau of Radiation Control
16. State of Connecticut Public Health Laboratory

Considerations in Test Sample Preparation

Test samples used in exercise should:

- Imitate two separate radiological events
- Contain naturally-occurring radionuclides commonly found in foods
- Allow to test method detectability relevant to FDA's DILs for ^{90}Sr and ^{239}Pu
- Allow to test false positive and false negative detections
- Allow to assess data quality
- Pose sufficient sample surge to the FERN network with >300 samples
- Have matrix composition to exercise various procedures and instruments
- Show traceability to the primary standards

Apple Juice Sample Preparation & Verification



Alpha spike was verified within -0.67%

Beta spike was verified within 0.09%

The test samples categories:

- Unknowns spiked with either ^{239}Pu or ^{90}Sr at two concentration levels
- Matrix blanks
- Control samples

Note: Each apple juice sample contains ~1.4 Bq/kg of naturally-occurring ^{40}K.

Methods and Resources Applied for CBCT Exercise

Methods Applied in Early Phase

- LSC
  1. Direct Measurement
  2. Solid-Phase Extraction
- GPC
  1. Wet Ashing/Count
  2. Evaporation/Count (EPA 900)

Methods Applied in Recovery Phase

- GPC
  1. TBP Extraction/Count
  2. Sr Resin/Count
  3. Co-precipitation/Count
  4. Extraction Resins/Count (Eichrom ACW17 VBS)
- LSC
  1. Sr Resin/Counting
- Alpha Spec
  1. TRU/Anion Exchange Resins/Count
  2. DGA Resin/Count
  3. ASTM 3084-89
  4. Extraction Resins/Count (Eichrom ACW17 VBS)

Resources Applied for CBCT Exercise

- Requested and received $20K from DHS via interagency fund transfer
- Utilized FERN website - Lab Directory to coordinate exercise activities
- Provided radioactive standards and lab supplies from the FERN storeroom
- Prepared ~340 apple juice test samples and pledged 16 FERN laboratories
- Consolidated FERN network results for stress test of ICLN data exchange utility

Analytical Results and Data Report

Early Phase:

Samples tested for gross alpha = 76

Samples tested for gross beta = 110

Recovery Phase:

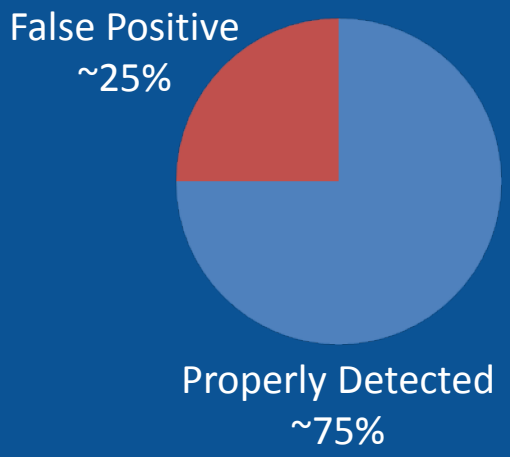
Samples analyzed for ^{239}Pu = 51

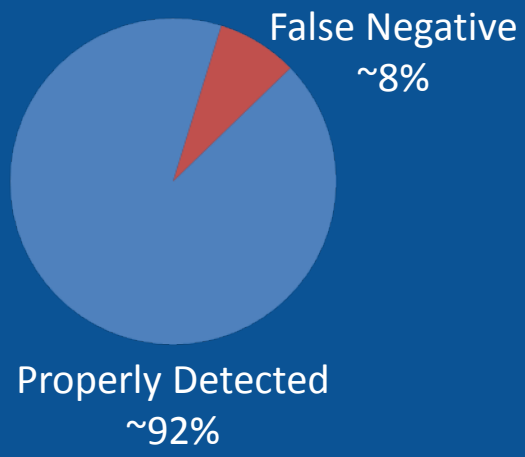
Samples analyzed for ^{90}Sr = 85

Samples completed during CBCT exercise
322

ICLN Expectation for FERN network
200 - 300

Frequency of False Positive/Negative Detections and Sample Loss





Observations and Discussions

- K-40 Interference
- Instrument Failure
- Calculation Errors
- Problem with Uploading Results
- Sample Processing Errors
- Method Shortcoming
- Run out of Supplies

Key Constrains and Proposed Action Items

With only ~44% participation rate for the FERN network, the current screening capacity is substantially below the sample surge resulted from a large-scale nuclear or radiological emergency. The following constraints should be addressed:

- Shortage of instrument such as alpha spectrometer, liquid scintillation counter, or gas-flow proportional counter which are necessary for detecting alpha/beta radioactivity
- Lacking laboratory infrastructure such as adequate acid fume hood for safely performing sample digestion and radiochemical separation
- Short of manpower for quick turnaround sample analysis due to heavy routine workload and other obligations
- Lack of skilled and qualified analysts who are proficient on complex radiochemical analysis
- Limited budget hindering method implementation and analyst training

To All Participants

Your participations in the ICLN rad exercise have provided wealth of information for future improvement, a list of action items, and opportunities for interlaboratory collaborations.

Thank You!