



EPA

United States
Environmental Protection
Agency

EPA's Participation in the ICLN Full-Scale Radiological Laboratory Exercise

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National Analytical Radiation Environmental Laboratory
(NAREL)

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Integrated Consortium of Laboratory Networks (ICLN)



ICLN was established through a memorandum of agreement (MOA) between 10 federal and independent agencies.

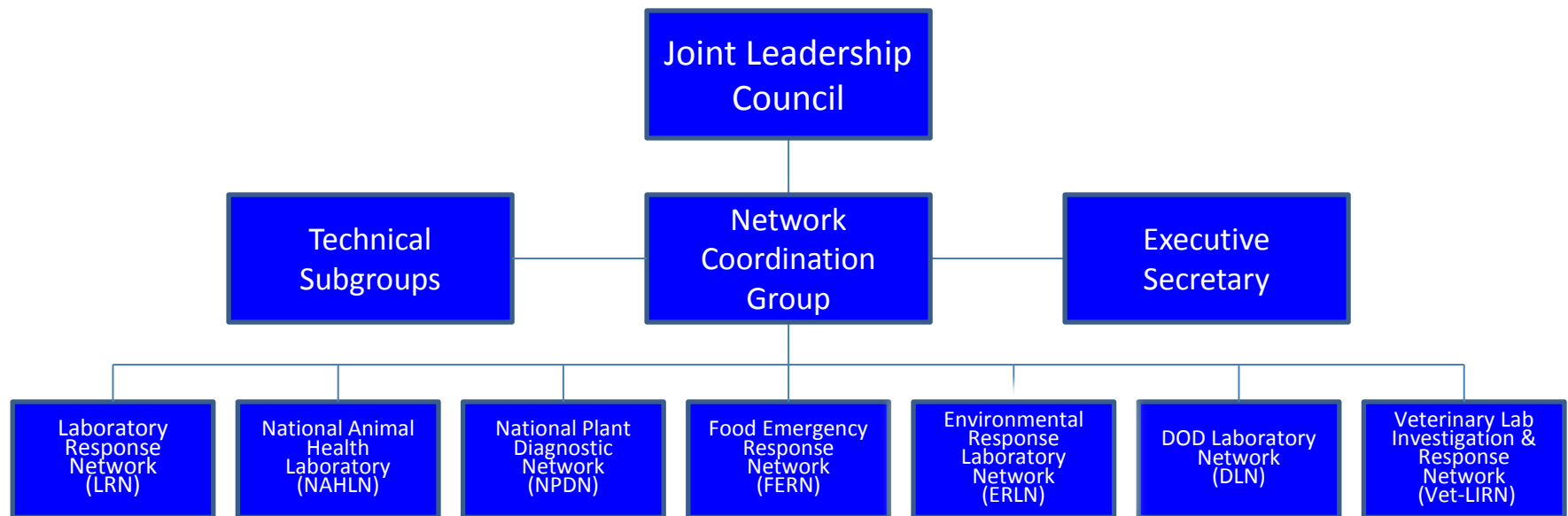


ICLN Full-Scale Exercise Planning Team

- The Planning Team for the exercise was composed of representatives from:
 - US Environmental Protection Agency (EPA)
 - Department of Homeland Security (DHS)
 - Centers for Disease Control (CDC)
 - US Food and Drug Administration (FDA)
 - US Department of Energy (DOE)
 - US Department of Agriculture (USDA)
 - National Institute of Standards and Technology (NIST)

EPA's Purpose

The exercise was initiated to assess the ability of the EPA's Environmental Response Laboratory Network (ERLN) to support responses to a radiological/nuclear event.



EPA's Goals and Objectives

- To assess EPA's ability to
 - Identify analytical criteria for a united analytical effort
 - Identify and access qualified network labs and provide with *measurement quality objectives/analytical protocol specifications* (MQOs/APSs)
 - Provide selected laboratories with guidance to ensure successful analysis and reporting of results
 - Prepare and ship samples to ERLN laboratories

EPA's Goals and Objectives (continued)

- Assess the ability of labs to interface with the ERLN WebEDR program
- Assess the ability of WebEDR to facilitate collation and verification of data based on QC and results uncertainty
- Assess the ability of EPA to use WebEDR to verify results
- Assess the ability of WebEDR to use ICLN portal Minimum Data Elements (MDE) to transfer results to other ICLN member networks

Scenario - Denver

- **DENVER:** Denver, Colorado was notionally impacted by an RDD containing strontium-90 (a beta-emitter)
 - An RDD was detonated at the State Capitol causing serious damage to nearby buildings and cars.
 - A 36 block radius believed to be contaminated.
 - Many fatalities and injuries.
 - Positive readings on Geiger counters and prevailing NNE winds.
 - Memorial Day events and baseball game at Coors Field.

Scenario - Chicago

- **CHICAGO:** Chicago, IL (Chicago O'Hare Airport) was notionally impacted by an RDD containing plutonium-239 (an alpha- emitter)
 - An RDD was detonated just outside Terminal 1 at Chicago O'Hare Airport.
 - All incoming and outgoing flights for this terminal were stopped.
 - Terminal 1 was damaged and non-functional – windows blown out and planes close by were incapacitated.
 - 240 fatalities and 100 airline employees injured.

Measurement Quality Objectives

- Measurement Quality Objectives (MQOs) were defined for each analyte and matrix by setting a required minimum detectable concentration (RMDC) value that targeted 10% required method uncertainty at action levels for the two phases:
 - Early Phase
 - Recovery Phase

EPA's MQOs for ICLN Full-Scale Exercise

Phase of Event Targeted AAL	Number of Samples and Matrix	Analyte	AAL (pCi/L)	Required MDC (pCi/L)
Early 15 mrem/y	20 Waters	$^{239/240}\text{Pu}$	51	2.4
	20 Waters	^{90}Sr (Total Sr)	360	15
Recovery 4 mrem/y	60 Waters	$^{239/240}\text{Pu}$	14	1.0
	60 Waters	^{90}Sr (Total Sr)	96	7.0

AAL - Analytical Action Level; MDC - Minimum Detectable Concentration

AALs for 4 and 15 mrem/y calculated per Tables 10A and 10B and guidance in the Radiological Laboratory Sample Analysis Guide for Incidents of National Significance—Radionuclides in Water, EPA 402-R-07-007, January 2008. The Required MDC values are estimates that target 10% or lower relative uncertainty in results at the action level concentration.

EPA's Methodology for the Exercise

- Laboratories received and analyzed samples to meet MQOs and APSs, and reported results for 160 samples per the labs' quality manual requirements:
 - Early phase: 20 water samples each for Pu and Total Sr (^{90}Sr), and
 - Recovery phase: 60 water samples each for Pu and Total Sr (^{90}Sr).
- Analytical results were reported via ERLN WebEDR
 - EDD and data package
- Data uploaded to WebEDR was verified to assess compliance with MQOs per MARLAP guidance.
- Once verified, analytical data was shared with other agencies via upload to the ICLN Portal utilizing the MDE format.

Laboratory Participation

- The laboratories included:
 - One federal laboratory (NAREL),
 - Five state laboratories, and
 - Four commercial laboratories.
- EPA pre-positioned samples at these ERLN laboratories to optimize limited resources.
 - Laboratories were instructed not to conduct sample receipt or login activities until the exercise was formally initiated (except to satisfy regulatory activities required when receiving materials under their radioactive materials license).

Laboratory Selection and Evaluation

- Identified and selected labs capable of performing the analyses
- Tasked labs with analyzing environmental samples to determine if contaminants were present above analytical action levels:
 - Early Phase: labs analyzed a small number of water samples
 - Recovery Phase: labs analyzed a larger number of water samples
- Labs submitted sample and QC results to the ERLN WebEDR
- EPA performed verification based on MARLAP guidance
- Used ICLN Minimum Data Elements (MDE) format to perform data exchange among participants on the ICLN Portal

Sample Distribution

Laboratory	Pu-239 (Early)	Total Sr (Early)	Pu-239 (Recovery)	Total Sr (Recovery)
NAREL	12	---	20	---
State Lab 1	---	---	3	---
State Lab 2	8	8	---	---
State Lab 3	---	---	3	3
State Lab 4	---	---	---	4
State Lab 5	---	---	---	5
Comm Lab 1	---	12	7	5
Comm Lab 2	---	---	12	20
Comm Lab 3	---	---	12	20
Comm Lab 4	---	---	3	3
TOTAL	20	20	60	60

Sample Preparation



Documentation

- Radioactive Materials License
- Analytical Services Request Form
- Additional Instructions
- Chains of Custody

Analytical Services Request (ASR) Form

Environmental Response Laboratory Network (ERLN) Analytical Services Request Form

2014 ICLN Full-scale Radiological Exercise – Response and Recovery Phase

Date of Request	Project Name
10/17/2014	<p align="center">**EXERCISE**</p> <p>Project Name: EXERCISE_RAD CBCTFSE_DENVER_CHICAGO_MAY_2014 Project Identifier: 2014 ICLN RAD FSE</p> <p align="center">**EXERCISE**</p>

Analytical Request Information – Response Phase				
Up to No. of Samples	Matrix	Analytical Method	Turn Around Time*	MQO Method ID (MQO Short name)
12	Water, preserved w HNO ₃	Isotopic Pu by Alpha Spe	7 days	Isotopic Pu by Alpha Spec-Early
12	Water, preserved w HNO ₃	Sr-90 (Total)	7 days	Sr-90 (Total) – Early

* Turnaround Time is listed in calendar days unless specified otherwise in the Special Requirements section below.

Analytical Request Information – Recovery Phase				
Up to No. of Samples	Matrix	Analytical Method*	Turn Around Time*	MQO Method ID (MQO Short name)
20	Water, preserved w HNO ₃	Isotopic Pu by Alpha Spec	7 days	Isotopic Pu by Alpha Spec-Recov
13	Water, preserved w HNO ₃	Sr-90 (Total)	7 days	Sr-90 (Total) – Recovery

* Turnaround Time is listed in calendar days unless specified otherwise in the Special Requirements section below.

Analytical Services Request Form (Page 2)


Environmental Response Laboratory Network (ERLN) Analytical Services Request Form

2014 ICLN Full-scale Radiological Exercise – Response and Recovery Phase

Sample Handling Information		
Proposed Sampling Period	Start Date: N/A	End Date: N/A
Proposed Shipping Period	Start Date: 10/27/2014	End Date: 10/30/2014

Special Requirements				
Analysis Start Date:				
Samples will be received during the shipping period of 10/27/2014 – 10/30/2014. The laboratory shall begin sample analysis once directed by the Technical Points of Contact.				
Analysis of the samples for the Recovery Phase shall begin only if the analysis is complete for the Response Phase samples and data submitted to WebEDR.				
The turnaround time for the analysis will be 7 business days.				
Analyze for the following analytes only:				
MQO ID	Analyte Name	CAS No.	Analyte Type	Required Minimum Detectable Concentration (RMDC)* [Analytical Action Level (AAL)]
Sr-90 (Total) – Early	Sr-90 (Total)	10098-97-2	Target in water	RMDC = 15 pCi/L [AAL=360 pCi/L]
Isotopic Pu by Alpha Spec-Early	Pu-238, Pu-239	13981-16-3,15117-48-3	Target in water	RMDC = 2.4 pCi/L [AAL=51 pCi/L]
Sr-90 (Total) – Recovery	Sr-90 (Total)	10098-97-2	Target in water	RMDC = 7.0 pCi/L [AAL=96 pCi/L]
Isotopic Pu by Alpha Spec-Recov	Pu-238, Pu-239	13981-16-3,15117-48-3	Target in water	RMDC = 1.0 pCi/L [AAL=14 pCi/L]

Chain of Custody

				CHAIN OF CUSTODY RECORD NATIONAL ANALYTICAL RADIATION ENVIRONMENTAL LABORATORY								540 South Morris Ave. Montgomery, AL 36115-2601 (334) 270-3400 Fax (334) 270-3454		Shipping Container #							
Project Name: ICLN Full-Scale Radiological Exercise				# of CONTAINER S	ANALYSIS REQUESTED								For Laboratory Use Only								
Contact Name: Cindy White					Pu E A R L Y									Comments:							
USEPA/NAREL 540 S. Morris Avenue Montgomery, AL 36115 334-270-7052																					
Contact Email Address: white.cindy@epa.gov						Requested TAT: 7 business days															
Sample Description	Date	Time	Matrix												Comments	Lab Sample ID					
ICLN-9180	04-09-14	1500 CDT	Water	1	X																
ICLN-6491	04-09-14	1500 CDT	Water	1	X																
ICLN-9409	04-09-14	1500 CDT	Water	1	X																
ICLN-3243	04-09-14	1500 CDT	Water	1	X																
ICLN-1171	04-09-14	1500 CDT	Water	1	X																
ICLN-5402	04-09-14	1500 CDT	Water	1	X																
ICLN-1393	04-09-14	1500 CDT	Water	1	X																
ICLN-5776	04-09-14	1500 CDT	Water	1	X																
ICLN-3948	04-09-14	1500 CDT	Water	1	X																
ICLN-9050	04-09-14	1500 CDT	Water	1	X																
ICLN-4288	04-09-14	1500 CDT	Water	1	X																
ICLN-2246	04-09-14	1500 CDT	Water	1	X																
1) Sampled By: _____ Date/Time: _____				2) Received By: _____ Date/Time: _____				Sample Shipped via FedEx UPS Hand Other				Internal Container Temperature ____ °C									
3) Relinquished By: _____ Date/Time: _____				4) Received By: _____ Date/Time: _____				Custody Seal Present? Y N				Page ____ of ____									
5) Relinquished By: _____ Date/Time: _____				6) Received By: _____ Date/Time: _____				Custody Seal Intact? Y N													
Samples Disposed By: _____ Date/Time: _____				Disposal Method: _____																	

NAREL/FORM-1 Revision-4 10/24/14

Quality Assurance and Quality Control

- Laboratories were instructed to comply with their internal quality system requirements.
 - Laboratories processed and analyzed samples in accordance with their quality manuals.
 - Quality control results were reported with the sample results.
- The analytical request form specified that a minimum of one (1) LCS, one (1) method blank sample and one duplicate be performed for each preparation batch of up to 20 samples.
- Data verification of the limited data set was performed based on applicable sections of MARLAP.
- Internal laboratory quality control results were evaluated consistent with guidance in MARLAP Chapter 18 (18.4.1 and 18.4.3) assuming a required relative method uncertainty of 10% at the AAL.

Statistical Performance All Labs – Spike Recoveries

Phase	# of Results	Mean (%)	Median (%)	5 th Percentile (%)	95 th Percentile (%)
Early ^{239/240} Pu	10	97.5	97.2	90.9	103.0
Recovery ^{239/240} Pu	29	97.4	97.5	88.4	107.8
Early ⁹⁰ Sr	10	101.2	101.3	95.8	105.5
Recovery ⁹⁰ Sr	28	91	85	76	107

Note: 3 outliers excluded

Statistical Performance All Labs – Blanks

Phase	# of Results	Mean (pCi/L)	Median (pCi/L)	5 th Percentile (pCi/L)	95 th Percentile (pCi/L)
Early ^{239/240} Pu	10	0.026	-0.004	-0.018	0.13
Recovery ^{239/240} Pu	30	0.001	0.000	-0.020	0.032
Early ⁹⁰ Sr	10	0.11	0.000	-0.74	1.2
Recovery ⁹⁰ Sr	28	0.18	0.045	-0.71	1.1

Note: 2 outliers excluded

Lessons Learned

- The WebEDR application wasn't very user-friendly:
 - Laboratories had trouble implementing EDD specifications;
 - Error messages generated during upload were not very informative;
 - WebEDR required every measured result to have an expected value;
 - Inconsistencies in lab-entered project identifiers led to temporary “loss” of data when the system was not able to retrieve results for inspection and review of data.

More Lessons Learned

- ERLN EDD specifications and Analytical Services Request lacked sufficient information:
 - ASRs did not clearly identify the Method ID (e.g., “Isotopic Pu by Alpha Spec” or “Isotopic Pu by Alpha Spec-Early”);
 - QC requirement specifications were not initially specific (QC is not always specified in performance based methods);
 - Chains of Custody (COCs) were not numbered. This was a required field in the EDD.
- On the first day of the exercise, the laboratories waited for someone to instruct them to start analyzing the samples.

Acknowledgments

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- NAREL Counting Room Staff
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- Stan Morton, PhD, EMS, Inc.
- Participating Laboratories

Questions?

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