CHAPTER 10

Quality assurance (QA) consists of planned and systematic activities that give confidence in the results of environmental surveillance monitoring programs (NCRP 2012). Environmental surveillance monitoring programs include: air (e.g., air filters, quarterly composites), atmospheric moisture, precipitation, drinking water, surface water, effluents, groundwater, agricultural products (e.g., milk, alfalfa, lettuce, potato, wheat), big game, soil, bats, and direct radiation. Environmental surveillance monitoring programs should provide data of known quality for assessments and decision-making. QA and quality control (QC) programs were maintained by Idaho National Laboratory (INL) Site contractors and laboratories performing environmental analyses.

GEL Laboratories, LLC (GEL) was rigorously assessed and audited in 2023 by the U.S. Department of Energy Consolidated Audit Program-Accreditation Program (DOECAP-AP), third-party accreditation bodies. No major audit findings were identified. Idaho State University's Environmental Assessment Laboratory was listed in the INL contractor respective environmental program's approved vendor list.

Analytical laboratories who seek and maintain accreditation from DOECAP-AP must acquire and analyze proficiency testing (PT) samples from an accredited PT provider. In 2023, GEL acquired and analyzed PT samples from Environmental Resource Associates and Eckert & Ziegler Analytics, Inc. PT programs and overall had acceptable results.

The environmental surveillance monitoring programs sent performance evaluation (PE) samples representing a variety of media for the purpose of demonstrating that a laboratory can successfully analyze samples within performance criteria during 2023. The INL Site contractors had a total of 322 analytes from various PE samples that were evaluated with 90% receiving an agreement evaluation. The nonagreements were reviewed and any unusual conditions were addressed, identified, and, when necessary, corrective actions were prepared to improve processes. Results are summarized in Section 10.4.

The multifaceted approach to QA and QC used by the INL Site contractors provide confidence that all laboratory data reported for 2023 are reliable and of acceptable quality.

10. QUALITY ASSURANCE OF ENVIRONMENTAL SURVEILLANCE MONITORING PROGRAMS

This chapter describes specific measures taken to ensure adequate data quality and summarizes performance.

10.1 Quality Assurance Policy and Requirements

INL Site contractors incorporate appropriate QA requirements and elements from 10 CFR 830, Subpart A, and DOE Order 414.1D, Change 2, to ensure environmental samples are representative and complete and data are reliable and defensible. Additional QA program requirements in 40 CFR 61, Appendix B, Method 114, must be met for all new point sources of radiological air emissions, as required by 40 CFR 61, Subpart H.

10.2 Program Elements and Supporting Quality Assurance Process

According to the National Council on Radiation Protection and Measurements (NCRP 2012), QA is an integral part of every aspect of an environmental surveillance monitoring program from the reliability of sample collection through sample transport, storage, processing, and measurement to calculating results and formulating the report. Uncertainties in the environmental surveillance monitoring process can lead to the misinterpretation of data and errors in decisions based on the data.

Every step in radiological environmental surveillance monitoring should be evaluated for integrity, and actions should be taken to evaluate and manage data uncertainty.

Meeting the requirements of state regulations, U.S. Environmental Protection Agency (EPA) directives, and DOE directives are an important part of developing an environmental sampling program. Gathering quantitative and qualitative environmental data is unique to each surveillance monitoring program. All data from planning, sample collection and handling, sample analysis, data review and evaluation, and reporting is complete, precise, and representative to ensure defensibility (Figure 10-1). Approved, detailed procedures are maintained, adequate training is given, and documents are controlled by the INL Site contractors and analytical laboratories to ensure that data are of acceptable precision and accuracy.

The main elements of environmental surveillance monitoring programs implemented at the INL Site, as well as the QA processes/activities that support them, are shown in Figure 10-1 and discussed below.

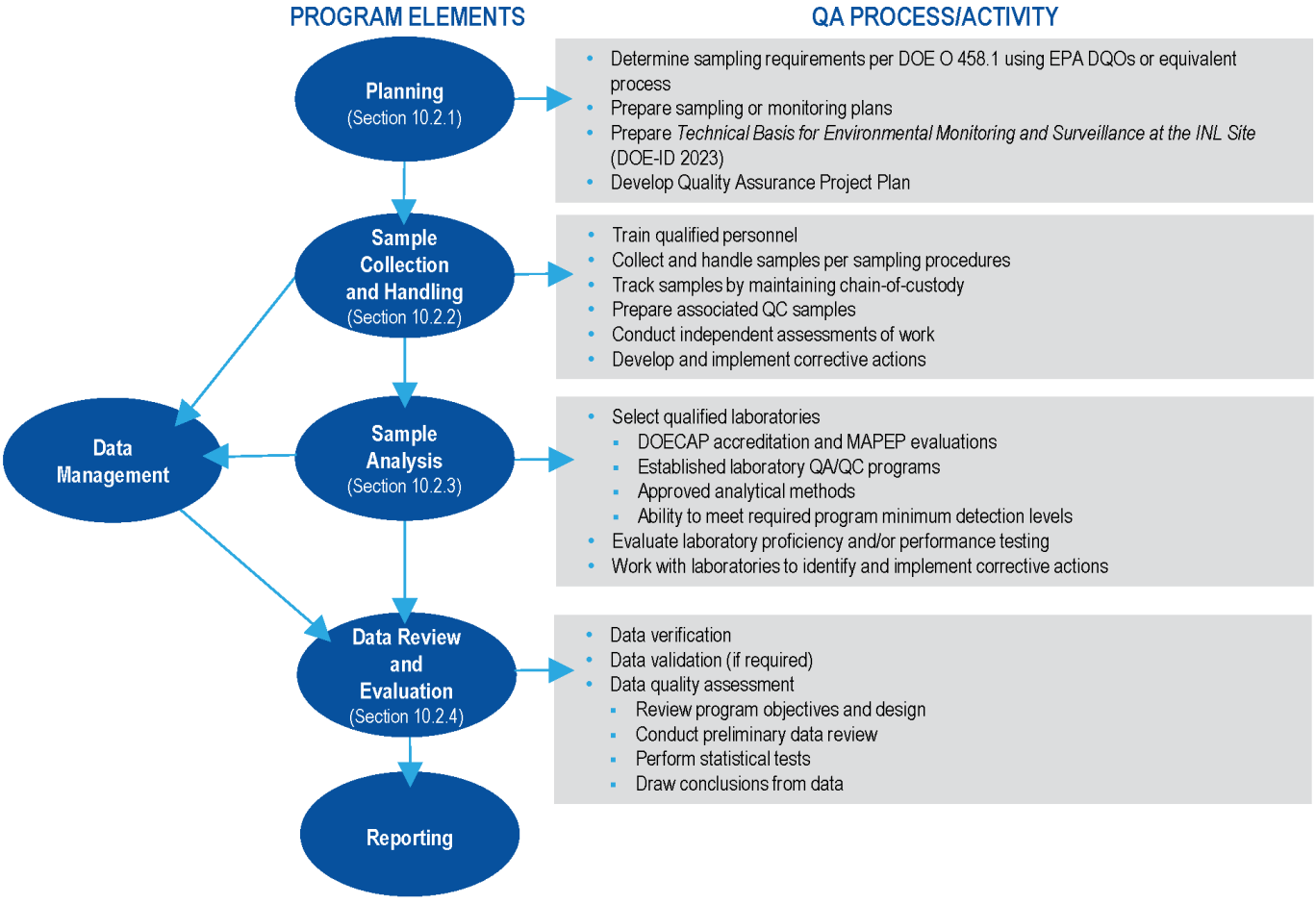

Figure 10-1. Flow of environmental surveillance monitoring program elements and associated QA processes and activities.

10.2.1 Planning

Environmental surveillance monitoring activities are conducted by the following:

- INL contractor
- Idaho Cleanup Project (ICP) contractor
- U.S. Geological Survey (USGS).

Each INL Site contractor determines sampling requirements using the EPA Data Quality Objective (DQO) process (EPA 2006) or its equivalent. During this process, the project manager determines the type, amount, and quality of data needed to meet DOE O 458.1, state and federal regulatory requirements, support decision-making, and address stakeholder concerns. These plans include:

Sitewide Monitoring Plans. The "Idaho National Laboratory Site Environmental Monitoring Plan" (DOE-ID 2021b) and "Idaho National Laboratory Groundwater Monitoring and Contingency Plan Update" (DOE-ID 2021a) summarize the various monitoring programs at the INL Site, including surveillance monitoring for air, water (e.g., surface, drinking, ground), soil, biota, agricultural products, external radiation, ecological, and meteorological monitoring on and near the INL Site; and surveillance/compliance monitoring for effluent on the INL Site. The plans include the rationale for monitoring, the types of surveillance media, where the sampling is conducted, and information regarding access to the analytical results.

QA Project Plan. Implementation of QA elements for sample collection and data assessment activities are documented by each INL Site contractor using EPA's recommended approach. The EPA policy on QA plans is based on the national consensus standard ANSI/ASQC E4-1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs." DQOs are project-dependent and are determined based on the needs of the data users and the purpose for which the data are generated. DQOs, sampling and analysis plans, and the "Technical Basis for Environmental Monitoring and Surveillance at the INL Site" (DOE-ID 2023) are integrated into the INL Site contractors QA project plans. Quality elements applicable to environmental surveillance and decision-making are specifically addressed in the "EPA Requirements for Quality Assurance Project Plans" (EPA 2001).

What is the difference between Quality Assurance and Quality Control in an environmental program?

- Quality assurance (QA) is an integrated system of management activities designed to ensure quality in the processes used to produce environmental data. The goal of QA is to improve processes so that results are within acceptable ranges.
- Quality control (QC) is a set of activities that provide program oversight (i.e., a means to review and control the performance of various aspects of the QA program). QC provides assurance that the results are what is expected.

QA project plans are developed for environmental surveillance monitoring media by each INL Site contractor to ensure that all collected data meet the requirements of all applicable federal and state regulations and DOE directives.

10.2.2 Sample Collection and Handling

Defensible laboratory data is a critical component of any environmental program. Field sample collection and handling coupled with a chain-of-custody that shows unique sample identification, weight, sample preservation, volume, holding time, approved procedures, and request of laboratory analysis are important steps of defendable data.

Strict adherence to program procedures is an implicit foundation of QA. In 2023, samples were collected and handled by trained personnel according to documented program procedures. Sample integrity was maintained through a system of sample custody records. Work execution assessments were routinely conducted by personnel independent of the work activity. Deficiencies were addressed by follow-up and corrective actions. Quality assessments are tracked in contractor-maintained systems.

QC sampling elements, as shown in Figure 10-2, are used by INL Site contractors to validate the collection process and verify the quality of laboratory preparation and analysis. These included the collection of trip blanks, field blanks,

equipment blanks, split samples, sample duplicates, and PE samples. Definitions for these elements/terms can be found in Appendix C. Glossary.

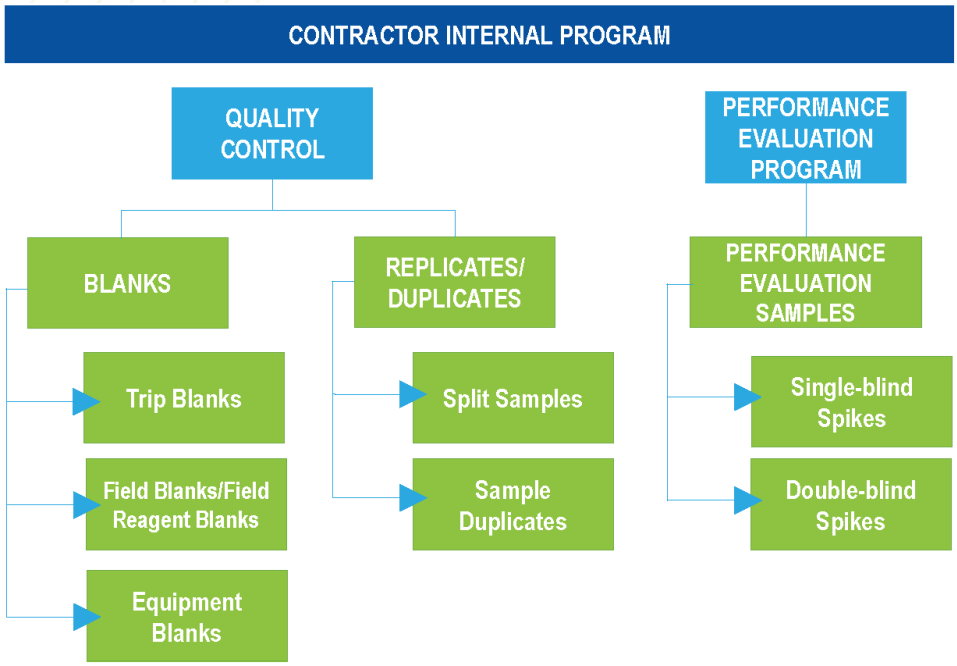

Figure 10-2. QC program sampling elements.

10.2.3 Sample Analysis

The following laboratories show in Table 10-1 were used by the INL Site contractors to analyze environmental surveillance samples in 2023.

Table 10-1. 2023 analytical laboratories used to analyze surveillance media.

ANALYTICAL LABORATORY	MEDIA				
	AIR	WATER	AGRICULTURAL PRODUCTS	BIOTA	SOIL
GEL Laboratories, LLC	X[a]	X[b]	X	X	—[c]
ISU-EAL[d]	X[a]	X[b]	X	X	—
RESL Laboratory	—	X	—	—	—

a. Includes atmospheric moisture.
b. Includes precipitation.
c. Not sampled in 2023.
d. ISU-EAL = Idaho State University-Environmental Assessment Laboratory

Laboratories used for routine analyses of radionuclides in environmental media were selected based on a laboratory's capabilities to meet program objectives, such as the ability to meet required detection levels, and past results in PT programs. The DOECAP-AP, which is comprised of third-party accreditation bodies, issues an annual accreditation certificate to laboratories seeking and maintaining accreditation. The rigorous accreditation process reviews each method, media, and analyte analyzed at the laboratory. An annual audit is performed to evaluate a laboratory's technical capability and competence, along with their proficiency in complying with DOE QA requirements as outlined in the Quality Systems Manual (QSM 2021).

No major audit findings were identified by DOECAP-AP third-party accreditation bodies for GEL that would influence the defensibility or quality of laboratory data in 2023. GEL maintained accreditation for 2023.

For more information on DOECAP-AP, visit the DOE Analytical Services Program webpage at www.energy.gov/ehss/analytical-services-program.

GEL participates in PT programs accredited to ISO 17043 as outlined in the QSM (QSM 2021). The laboratory is responsible for reviewing their PT results and correcting potential quality concerns identified by the PT provider. DOECAP annual accreditation is maintained by achieving two successful studies (e.g., acceptable scores) out of their most recent three attempts. Results for the PT programs are provided in Section 10.3.

The DOE Laboratory Accreditation Program (DOELAP) is responsible for implementing performance standards for DOE contractor external dosimetry program through periodic PT and on-site program assessments. Accreditation must be renewed on a triennial basis following periodic proficiency testing and on-site program assessments. Landauer is accredited through this program.

Laboratory data quality is continually verified by QC samples, as observed in Figure 10-3, and includes calibration verifications, blanks, replicates/duplicates, and intra-laboratory and PT samples.

An analytical laboratory may use several of the laboratory QC measurement elements identified in Figure 10-3. Results of the laboratory QC are presented to the INL Site contractors as a data package and provide assurance that the reported data are usable and defensible.

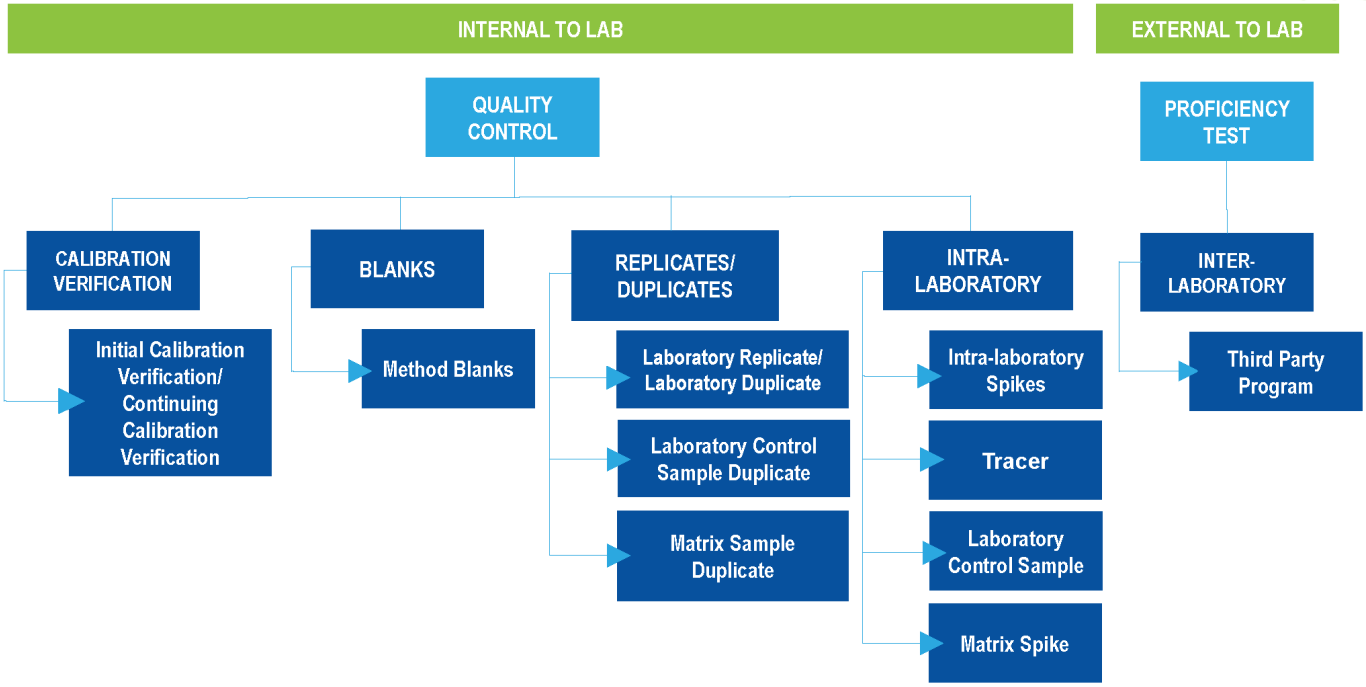

Figure 10-3. Laboratory measurement elements.

10.2.4 QC Data Review and Evaluation

Data that the INL Site contractors generate are routinely evaluated to understand and sustain data quality. This enables programs to determine whether the DQOs established in the planning phase were achieved and whether the laboratory is performing within its QA/QC requirements.

Environmental data may be subject to verification, validation, and quality assessment.

The Environmental Data Warehouse is the official warehouse for long-term management and storage of environmental data collected in support of INL Site contractors. Data stored in the Environmental Data Warehouse is used to support compliance reporting, decision-making, trending, and modeling. Appropriate testing is completed in the event any significant changes are made to the Environmental Data Warehouse database, or the server operating system on which

the data system reside, in accordance with the *Software Configuration Management Plan for INL Site Environmental Data Systems* (PLN-3844).

The INL Site contractors send media-specific PE samples to the laboratories for the purpose of testing the laboratories' ability to successfully analyze samples within performance criteria. These are compared with PT results and can provide valuable indicators that further QC testing may be required.

Figure 10-4 shows a decision tree of the process used for reviewing PE sample results along with sample data from the elements listed in Figure 10-2. When PE sample results are in agreement for the INL Site contractors, a review of the remaining data continues. If no issues are identified, the data package is approved. If the PE result is identified as a nonagreement, the INL Site contractor reviews all available PE and PT data.

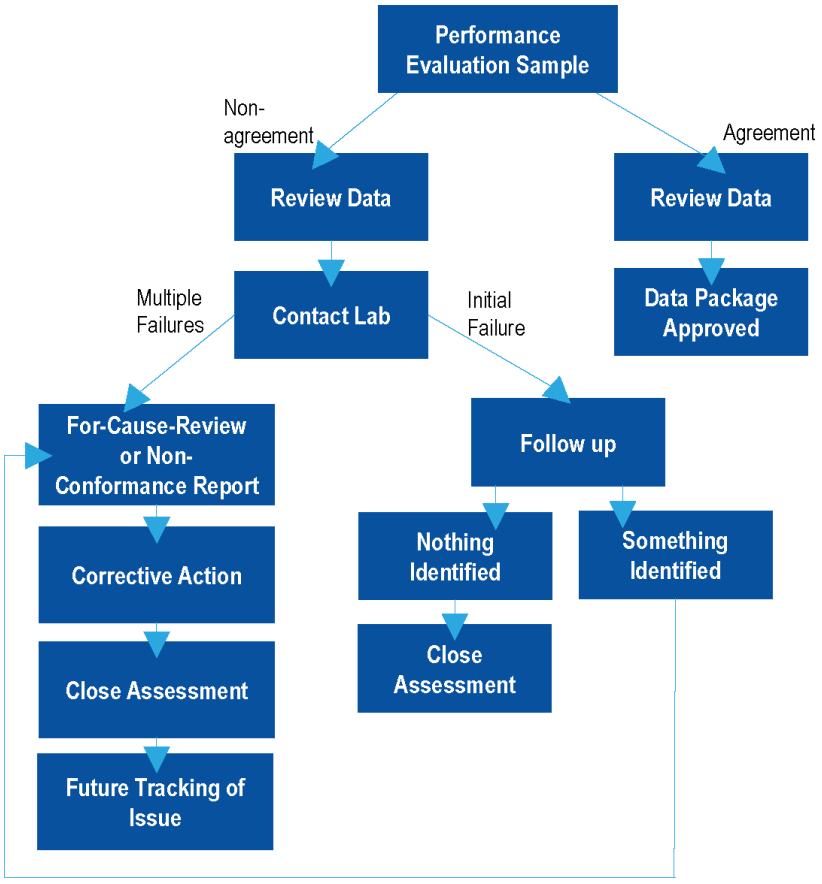

Figure 10-4. Environmental surveillance field sampling data PE review process.

A variety of items that may be considered for review include, but are not limited to, the following questions:

- Did the PE sample provider prepare the sample (single-blind or double-blind) within the range specified by their customer? If yes, begin looking into the other PE and PT results. If not, the PE sample may not be an accurate representation of the project-specific field conditions or field results. If the equipment is calibrated for the field concentration range, and the PE sample is not within that range, then the accuracy and representativeness of the PE sample may be called into question.
- Did the laboratory perform all the required program- and method-specific QC analyses using the process shown in Figure 10-3? Are these QC results within acceptable parameters?
- What does a review of the long-term project results indicate? Are all project-specific and analytic-method-specific PE results within specification? If not, does the laboratory have a history of out-of-specification QC results for a specific analyte?

Upon a review of the entire body of PE evidence and using both objective and subjective professional judgment, the INL Site contractor will determine if the nonagreement result is a one-time anomaly or if the laboratory needs to perform a review.

A "Follow-Up" review occurs after a single failure and may result in the laboratory not identifying any issues leading to the nonagreement result. At this point, the data package has good defensible data if the laboratory passed all their qualifying criteria (Figure 10-3). If a laboratory qualifying criterion is not met, the laboratory will re-prepare and re-analyze the samples. However, if there is not enough of a sample available, the laboratory may flag the data when the laboratory's "QC is Not Within Criteria" (Figure 10-3). When the "Follow-Up" review identifies issue(s), either a "For-Cause-Review" or a "Non-Conformance Report" may be requested.

A "For-Cause-Review" and/or "Non-Conformance Report" may be requested when multiple PE sample issues occur consecutively (e.g., a nonagreement evaluation for the same radionuclide in the same matrix) or as a result of a "Follow-Up" review. The laboratory would perform an investigation (e.g., review/verify sample units, weights, calculations) during a "For-Cause-Review." Whereas a "Non-Conformance Report" would generate a rigorous laboratory review (e.g., interview analysts, historical results). Both the "For-Cause-Review" and "Non-Conformance Report" could result in a "Corrective Action" being issued, which may resolve the problem and prevent future issues from occurring. Upon acceptance of the "Corrective Action," the assessment would be closed, and the issues discussed would be monitored in future data packages.

If the laboratory cannot identify issues following a "For-Cause-Review" and/or "Non-Conformance Report" resulting from multiple PE nonagreement evaluations, the INL Site contractor will work with the laboratory to assist in the investigative process. For example, additional PE samples may be provided to the analytical laboratory to determine whether any problems arise from sample preparation, data calculations, data entry into a database, etc. As a result, the laboratory will provide an acceptable "Corrective Action" to the INL Site contractor. The issue will be monitored for future PE samples. Depending on the severity, the contractor may hold onto the samples until the issue is resolved and may send a letter-of-concern to the laboratory. Based on the outcome of the investigation, the INL Site contractor could terminate the contract and seek another laboratory.

10.3 2023 Interlaboratory Program PT Evaluations

GEL maintained accreditation and had no major findings identified by DOECAP-AP for GEL in 2023. GEL also participated in PT studies for Environmental Resource Associates and Eckert & Ziegler Analytics, Inc. and overall had acceptable results.

Landauer maintained accreditation through DOELAP in 2023.

10.4 2023 INL Site Contractors QC Programs

Individual QC programs include the use of several elements, as shown in Figure 10-2 and Figure 10-3, respectively, to evaluate the performance of a laboratory. Not all QC measurement elements are required unless specifically called out in each INL Site contractor program's contract with the laboratory, or as required by the specific analytical method.

Field QC samples are sent to laboratories along with routine environmental samples to be analyzed in tandem. The samples are prepared in a way that the QC samples are analogous to the field samples. The laboratory is not aware of which samples are blanks, duplicates, or PE samples. Blanks are submitted along with the regular samples to test for the introduction of contamination during the process of field collection, laboratory preparation, and laboratory analysis. Duplicate/replicate samples are submitted with the regular samples to assess field collection, homogeneity, reproducibility, laboratory preparation, laboratory analysis, and precision.

A PE sample where the activity is known by the INL Site contractors, but not the analytical laboratory, is called a "single-blind" PE sample; whereas a PE sample where the activity is unknown to both the INL Site contractors and the analytical laboratory is referred to as a "double-blind" PE sample. PE samples are sent to the laboratory throughout the year. Evaluations of these samples are used to improve accuracy of the data by following the process identified in Figure 10-4.

In addition to the INL Site contractors' PE program, Mixed Analyte Performance Evaluation Program (MAPEP) is an interlaboratory program that uses evaluations to test the ability of the laboratories to correctly analyze radiological, nonradiological, stable organic, and stable inorganic constituents' representative of those at DOE sites. MAPEP provides QA oversight for environmental analytical services by performing a semiannual evaluation of commercial laboratories. GEL participated in the MAPEP Series 48 and 49 during 2023. The Idaho State University-Environmental Assessment Laboratory (ISU-EAL) participated in Series 48. Laboratories publish results from MAPEP in quarterly QA reports. These reports are reviewed by the INL Site contractors and compared with the internal PE results.

In the event a data quality or trending issue is identified, the concern will be documented in an Issues Management System to track resolutions and/or corrective actions.

10.4.1 INL Contractor QC Program

INL Contractor Blanks

No concerns were identified in blanks that would indicate data quality or trending issues with sampling, handling, shipment, or analysis by the laboratory contributed to the actual sample results in 2023:

- ***GEL Laboratories, LLC***
  A total of 170 analytes were analyzed by GEL in various media. The media analyzed included air filters, quarterly air filter composites, atmospheric moisture, precipitation, drinking water, and milk.

- ***ISU-EAL***
  A total of 97 analytes were analyzed by ISU-EAL in various media. The media analyzed included air filters, charcoal cartridges, quarterly air filter composites, milk, and precipitation.

INL Contractor Replicate/Duplicate

No concerns were identified in duplicates/replicates that would indicate data quality or trending issues with sampling, handling, shipment, homogeneity, reproducibility, or preparation and analysis by the laboratory contributed to the actual sample results for 2023:

- ***GEL Laboratories, LLC***
  A total of 607 analytes were analyzed by GEL Laboratories. The media analyzed included air filters, quarterly air filter composites, milk, produce, surface water, effluent, and groundwater.

- ***ISU-EAL***
  A total of 95 analytes were analyzed by ISU-EAL in various media. The media analyzed included air filters, charcoal cartridges, quarterly air filter composites, milk, and drinking water.

INL Contractor PE

In 2023, the INL contractor used GEL, ISU-EAL, and Landauer laboratories to provide analytical results for air (e.g., air filters, quarterly composites), atmospheric moisture, precipitation, drinking water, surface water, effluents, groundwater, agricultural products (e.g., milk, alfalfa, lettuce, potato, wheat), big game, soil, bats, and direct radiation.

Of the PE samples analyzed in 2023 by GEL, ISU-EAL, and Landauer, 191 (87%) PE analytes were in agreement, as indicated in Figure 10-5, with 25 (13%) PE analytes categorized as nonagreements.

How do these discrepancies between expected and actual PE sample results relate to field sample values? If a PE sample registers a result below the anticipated value, it indicates a low bias in the reference sample. This could imply that the true values for field samples from the same batch are understated in the laboratory's reports. On the other hand, if a PE sample records a result above the expected value, it points to a high bias. In this scenario, it is possible that the true values for field samples in the batch exceed the results reported by the laboratory.

Illustrating this point, Figure 10-6 presents a case where a low bias of 35% was found for a plutonium-239 (^{239}Pu) air filter PE composite analyzed during fourth quarter of 2023. Upon applying the 35% low bias correction to the maximum

observed ^{239}Pu concentration within the same air filter composite batch. The recalculated value for the routine sample is marginally elevated compared to its initially reported value and below the acceptable derived concentration limit.

However, it's standard practice not to correct laboratory field sample results for low/high biases identified through PE nonagreement. Such discrepancies typically do not influence decision-making regarding that particular analyte for that media, and data is not discarded due to nonagreement. Additional quality assurance and quality control (QA/QC) measures are also under review. PEs provide an opportunity for the INL contractor to work with the laboratory on nonagreements to identify processes, procedures, and methods that will lead to improved accuracy of data.

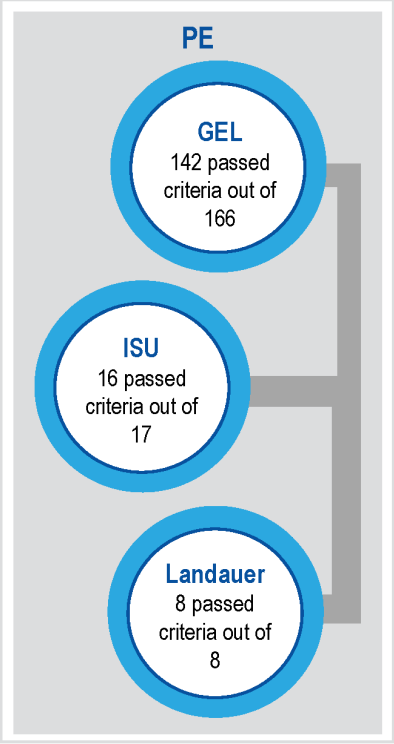

Figure 10-5. INL contractor 2023 PE analyte results.

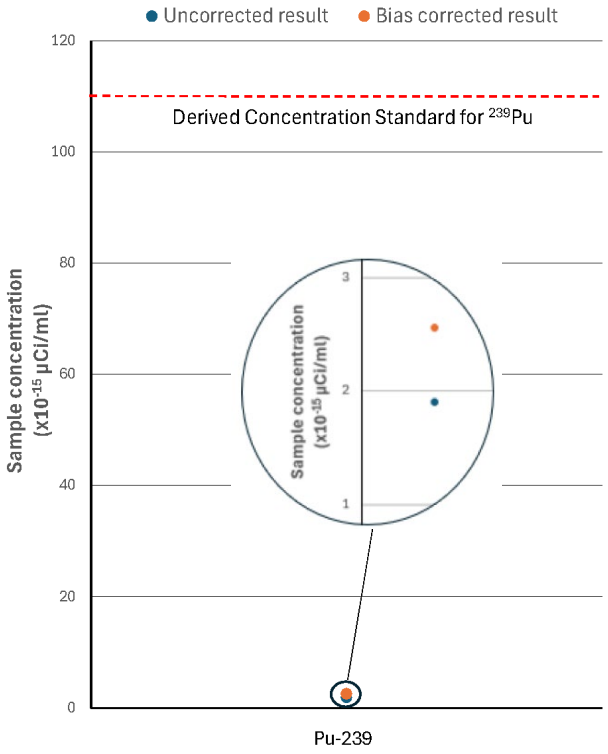

Figure 10-6. Comparison of nonagreement ^{239}Pu PE result to DCS (result correction and non-correction).

The INL contractor worked with the laboratories on nonagreements. Discussion points are listed below.

- ***GEL Laboratories, LLC***

  Air Filter Composites

  GEL received nonagreements for americium-241 (^{241}Am), plutonium-238 (^{238}Pu), ^{239}Pu, uranium-234 (^{234}U), and uranium-238 (alpha emitters) in a first quarter air filter composite PE sample. Results for the analytes exhibited about the same amount of bias when compared to the known values. Even though this was a first occurrence for alpha analytes analyzed by GEL, the laboratory was informed of the nonagreements, prompting GEL to perform an internal investigation. GEL identified an analyst error that occurred in preparation of the aliquot used for analysis that resulted in the low recoveries. The analyst left GEL prior to the internal investigation and audit. The audit reviewed multiple individuals aliquoting filter samples, and all procedures were performed properly.

  Nonagreement evaluations were received for zinc-65 (^{65}Zn) (gamma emitter) and ^{238}Pu and ^{239}Pu (alpha emitters) in a fourth quarter air filter composite PE sample. The INL contractor noted that a similar occurrence happened for ^{65}Zn in the second quarter 2023 PE composite sample. The laboratory was contacted and a request was made to review the ^{65}Zn nonagreement. Based on that review, the laboratory determined the ^{65}Zn nonagreement may be due to the air filter composite being direct counted rather than digested. A recommendation was made by GEL to have the composite samples digested and then counted. The INL contractor will work with the laboratory to determine which

process (direct or digestion) will improve the accuracy and precision of the results. The laboratory also reviewed the nonagreements for ^{238}Pu and ^{239}Pu (alpha emitters). The nonagreements were attributed to random counting statistics. The INL contractor reviewed the previous PE air filter composites, MAPEP, and ERA PT results and all analytes of interest for the composites were in agreement. This is a first occurrence for ^{238}Pu and ^{239}Pu and not indicative of a trend.

Agricultural Products

GEL received nonagreement evaluations for ^{65}Zn (gamma emitter) and strontium-90 (^{90}Sr) (beta emitter) in a milk sample. The INL contractor contacted the laboratory and requested a review of these nonagreements. Based on that review, the laboratory determined that the ^{65}Zn (gamma emitter) was an anomaly since no errors were found. The ^{90}Sr (beta emitter) was biased high due to a low yield on the sample; therefore, no further actions were taken. The INL contractor reviewed previous milk PE and PT results and found agreements for ^{90}Sr and ^{65}Zn. The INL contractor will continue to monitor future PE results.

Nonagreement evaluations for gamma emitters were identified for colbalt-57 in alfalfa, cobalt-60 and cesium-137 in lettuce, and ^{65}Zn in potato. Nonagreement evaluations were identified for the beta emitter (^{90}Sr) in alfalfa, lettuce, and grain. The INL contractor requested GEL review all nonagreement evaluations. GEL's investigation determined the nonagreements were due to samples not being completely consumed during the sample preparation. GEL requested the INL contractor to document sample preparation requirements on the chain-of-custody and contact the project manager so the message could be relayed to the analysis team. The INL contractor's corrective action for alfalfa, lettuce, grain, and potato PE samples will be to document on the chain-of-custody required sample preparation comments for each PE sample to either "analyze entire sample" for gamma emitters or to "consume entire sample" for beta emitters. The GEL project manager will be notified of these samples and instructions on the chain-of-custody.

Effluent and Groundwater

A total of 86 effluent and groundwater double-blind PE analytes were analyzed by GEL and evaluated by the PE sample provider in 2023. GEL received a nonagreement for six results. Two of the nonagreements were for gamma spectrometry on ^{241}Am and radium-226 results reported as non-detects; however, a review shows the PE provider prepared both analytes at levels less than the laboratory's contractual detection limits for the specific projects, so the non-detects are the expected results and considered correct. Two alpha spectrometry results received nonagreements, including ^{241}Am and ^{234}U. The remaining two nonagreements were for technetium-99 (^{99}Tc) and ^{90}Sr. The INL contractor requested GEL review and provide follow-up on these four nonagreements to determine whether corrective actions were necessary. GEL's follow-up response indicated the alpha spectrometry nonagreements were due to known sample activity being too close to detection levels. GEL's follow-up review of the ^{99}Tc and ^{90}Sr nonagreements were inconclusive as no errors were identified. The INL contractor reviewed previous PE, MAPEP, and ERA PT results for analytes of interest in effluent and groundwater and found they were in agreement. This is a first occurrence for these four analytes and not indicative of a trend. The INL contractor will continue to monitor GEL's performance on these analytes.

- ***ISU-EAL***

  Drinking Water

  A nonagreement evaluation was identified for gross alpha in drinking water and was a first-time occurrence. The INL contractor requested ISU-EAL to follow-up on the nonagreement. The ISU-EAL investigation identified that the PE sample was not acidified. The INL contractor requested a "For-Cause Review" to look at other samples in the group. ISU-EAL identified that the laboratory technician had acidified the other samples prior to analysis. The INL contractor reviewed all sample results and the results were comparable to historical values.

10.4.2 ICP Contractor QC Program

ICP Contractor Blanks

No concerns were identified in blanks that would indicate data quality or trending issues with sampling, handling, shipment, or analysis by the laboratory contributed to the actual sample results in 2023.

- ***GEL***
  A total of 353 analytes were analyzed by GEL in perched water and groundwater media. A single groundwater result was flagged for noncompliance due to negative chlorine-36 activity.

ICP Contractor Replicate/Duplicate

No concerns were identified in duplicate/replicates that would indicate data quality or trending issues with sampling, handling, shipment, homogeneity, reproducibility, or preparation and analysis by the laboratory contributed to the actual sample results for 2023.

- ***GEL***
  A total of 198 analytes were analyzed by GEL Laboratories in perched water and groundwater media.

ICP Contractor PE

In 2023, the ICP contractor used GEL to provide analytical results for air filters, quarterly composite air filters, perched water, ground water, liquid effluent, and wastewater.

Of the PE samples analyzed in 2023 by GEL, 131 (95%) PE analytes were in agreement with only seven (5%) PE analytes categorized as nonagreements. The ICP contractor worked with the GEL on nonagreements to identify processes, procedures, and methods that will lead to improved accuracy of the data. Discussion points are listed below.

- ***GEL Laboratories, LLC***

  Air Filter Composites
  Results for the air surveillance program were flagged due to low bias for ^{90}Sr, ^{134}Cs, and plutonium-238 (^{238}Pu). The ICP contractor contacted GEL, and it was found that the ^{238}Pu sample in question was not filtered. The ^{134}Cs and ^{90}Sr results did not agree with the known value which GEL attributed to longer counts. These instances were single events and are not indicative of a trend.

  Surface Water
  Results for the surface water program were flagged due to low bias for ^{241}Am and ^{239}Pu. The ICP contractor communicated with GEL, and it was discovered that the results did not agree with the known value due to longer counts. The lab has taken steps to address the confusion and subsequent analyses have proven more reliable. When compared to previous MAPEP and PE results, the results are similar and do not indicate a trend.

10.4.3 USGS QC Program

In 2023, the USGS used the Radiological and Environmental Sciences Laboratory (RESL) to provide analytical results for groundwater monitoring wells. USGS submits field blanks along with regular samples to test for the introduction of contamination during the process of field collection, laboratory preparation, and laboratory analysis.

USGS Blanks

No concerns were identified in blanks that would indicate data quality or trending issues with sampling, handling, shipment, or analysis by the laboratory contributed to the actual sample results in 2023.

- ***RESL***
  A total of 10 analytes were measured in three groundwater samples by RESL laboratories to evaluate blank data quality.

USGS Replicate/Duplicate

No concerns were identified in duplicates/replicates that would indicate data quality or trending issues with sampling, handling, shipment, homogeneity, reproducibility, or preparation and analysis by the laboratory contributed to the actual sample results for 2023.

- ***RESL***
  A total of 27 analytes were measured in nine groundwater samples by RESL laboratories to evaluate reproducibility between environmental and sequentially collected replicates.

10.5 Conclusions

The quality elements presented in Figure 10-1 were implemented in 2023. The field sampling elements (Figure 10-2), laboratory measurements (Figure 10-3), and PE samples were reviewed and evaluated for each INL Site contractor and are summarized in Section 10.4. It has been determined that all laboratory data presented in this report are valid, reliable, and defensible.

10.6 References

10 CFR 830, Subpart A, 2023, "Quality Assurance Requirements," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, Washington, D.C., https://www.ecfr.gov/current/title-10/chapter-III/part-830/subpart-A.

40 CFR 61, Appendix B, 2023, "Test Methods, Method 114, Test Methods for Measuring Radionuclide Emissions from Stationary Sources," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, Washington, D.C., https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-61/appendix-Appendix%20B%20to%20Part%2061.

40 CFR 61, Subpart H, 2023, "National Emission Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, Washington, D.C.,https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-61/subpart-H.

ANSI/ASQC E4-1994, 1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs," American National Standards Institute/American Society for Quality Control, Washington, D.C.

DOE O 414.1D, 2011, Chg 2 (LtdChg), 2020, "Quality Assurance," U.S. Department of Energy, Washington, D.C., https://www.directives.doe.gov/directives-documents/400-series/0414.1-BOrder-d-chg2-ltdchg/@@images/file.

DOE O 458.1, 2020, "Radiation Protection of the Public and the Environment," Administrative Change 4, U.S. Department of Energy, Washington, D.C., https://www.directives.doe.gov/directives-documents/400-series/0458.1-BOrder-chg4-ltdchg/@@images/file.

DOE-ID, 2023, "Technical Basis for Environmental Monitoring and Surveillance at the INL Site," DOE/ID-11485, Rev. 2, U.S. Department of Energy, Idaho Operations Office, Idaho Falls, ID.

DOE-ID, 2021a, "Idaho National Laboratory Groundwater Monitoring and Contingency Plan Update," DOE/ID-11034, Rev. 4, U.S. Department of Energy, Idaho Operations Office, Idaho Falls, ID.

DOE-ID, 2021b, "Idaho National Laboratory Site Environmental Monitoring Plan," DOE/ID-11088, Rev. 5, October 2021, U.S. Department of Energy, Idaho Operations Office, Idaho Falls, ID.

EPA, 2001, "EPA Requirements for Quality Assurance Project Plans," (EPA QA/R-5), EPA/240/B-01/003, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 2006, "Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4)," EPA/240/B-06/001, February 2006, U.S. Environmental Protection Agency, Washington, D.C.

NCRP, 2012, "Design of Effective Radiological Effluent Monitoring and Environmental Surveillance Program," NCRP Report No. 169, National Council on Radiation Protection and Measurements, Bethesda, MD.

PLN-3844, 2023, "Software Configuration Management Plan for INL Site Environmental Data System," Rev. 7, March 27, 2023, Idaho Cleanup Project, Idaho Falls, ID.

QSM, 2021, "Department of Defense (DOD) Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories," based on ISO/IEC 17025:2017(E) and The NELAC Institute (TNI) Standards, Volume 1, (September 2009), DOD Quality Systems Manual Version 5.4 (2021), Washington, D.C.