Chapter 6
Application of Data to Risk Assessment

This chapter discusses the application of radioanalytical data for risk assessment. Guidance is provided for reviewing data for consistency and completeness and for evaluating observed contamination, source term quantity, and contamination levels. Because similarities exist between the evaluation and application of analytical data for radioactive and nonradioactive risk assessment, the reader is encouraged to review the discussions provided in Part A, Chapter 6.

Before radioanalytical data can be used for risk assessment, the user must determine the acceptability and usefulness of the data sets derived from the field and laboratory analyses. The data user should then review the entire data package for consistency and completeness among the data sets. At a minimum, this review should focus on the following areas:

- Radionuclides of concern.
- Discrimination of site contamination from background.
- Exposure pathways.
- Documentation of analytical procedures and results.

6.1 RADIONUCLIDES OF CONCERN

The data user should review the list of radionuclides of concern for each migration pathway for completeness with respect to the criteria listed in Section 3.2:

- Atomic number and atomic weight.
- Radioactive half-life.
- Principal decay modes, radiation decay modes, energies, and abundances.
- Chemical and physical form.
- Decay products.

6.2 DISCRIMINATION OF SITE CONTAMINATION FROM BACKGROUND

Radionuclide specific activity concentrations (and radiation exposure rates, where applicable) for background samples are required for each pathway. These data are used to characterize the naturally occurring levels of radionuclides in all pertinent media and to facilitate discrimination of site contamination from background. These data need to be of sufficient quality for risk assessment purposes. Data quality depends on whether background levels were determined by site-specific analysis or were derived from the literature. In general, site-specific background data are recommended over values obtained from the literature because site-specific measurements can account for the local background variability, and the quality of site-specific analytical data can be directly assessed through the use of QA/QC samples.

Care must be taken to ensure that the appropriate background sample is taken for each analytical sample, and that the background sample is the equivalent of the analytical sample. It must originate in the same conditions of an uncontaminated area, e.g., the same soil classification as a borehole sample taken on site, but from an environmentally uncontaminated area.

When published data are used to establish background concentrations, the data must be determined to be representative of the site. The concentration utilized to represent the background should be in the 95% upper confidence limit of the range of literature data.

Ideally, both site-specific data and that from the literature should be available and utilized to draw comparisons between and conclusions about the quality of background concentration data. Reported background values for a specific radionuclide in a given medium that fall outside (i.e., either below or above) the concentration range expected from values in the literature, should alert the data user to the need to review the appropriateness or representativeness of the background sampling location or the performance and sensitivity of sampling and analysis techniques, radiochemical procedures, or measurement techniques.

6.3 EXPOSURE PATHWAYS

The risk assessor should review the data package to ensure that all relevant exposure pathways have been sampled and that radioanalytical data are provided for these pathways. For example, evaluation of the soil exposure pathway should include measurements of activity concentrations of radionuclides in soil, as well as external radiation exposure measurements from all

Acronyms

QA	quality assurance
QC	quality control
SAP	sampling and analysis plan
SOP	standard operating procedure

contaminated areas. The locations of all background and site sampling points should be clearly defined and marked on the site map.

6.4 DOCUMENTATION OF ANALYTICAL PROCEDURES AND RESULTS

All radioanalytical procedures used to determine site data should be documented. These procedures and resulting data sets should be reviewed to determine whether the proper procedures were used for the types, abundances, and energies of the radiations emitted by each radionuclide and should ensure that the data are presented in the appropriate activity concentration units (e.g., pCi/g dry weight or pCi/g wet weight for soil, pCi/L for water, pCi/g fresh weight or pCi/g dry weight or pCi/g ash weight for vegetation, or pCi/m^3 for air), along with their associated error. The required activity concentration units should be specified in the samp[ling and analysis plan (SAP).

To document radiochemical results properly, a detailed compilation of supporting documentation is required. Records of all types should be continuous. Data originally recorded in a notebook may be transferred to a form, entered into a computer, and finally printed as either input parameters or as intermediate, calculated data. In these cases, copies of all supporting logbooks and forms are required, not just the final printed copy. To support the reported analytical data, a broad range of documentation should be required of the analytical laboratories. The materials required for QA support documentation are shown in Exhibit 12.

EXHIBIT 12. RADIOCHEMICAL QUALITY ASSURANCE SUPPORT DOCUMENTATION

Sample Collection Data:

- Field survey data
- Sample collection field logs
- Field preparation data sheets
- Shipping/transmittal forms
- Chain-of-Custody forms
- Sample receipt logs
- Sample login forms/logs
- Laboratory analysis request and distribution forms
- Calibration data for sample collection equipment
- Radiation screening information
- Copy of NRC/State RAM license of party receiving samples

Analytical Data:

Preparation/Chemistry Data

- Sizes of aliquots processed
- Concentration/dilution factors
- Chemical yield data
- Evidence of preparation of counting aliquots
- Dates and times of processing and separations
- Analogous data for applicable QC samples
- Initials of the analyst(s)
- Copy of SOPs used for preparation

Counting Data

- Sample sizes and counting geometries
- Sample counts
- Background counts
- Reagent blank counts
- Acquisition times, sample & background
- Date and times of all counting
- Counter efficiencies
- Identification of analysts
- Identification of counters used
- Counter printouts, including but not limited to peak search and quantitation printouts for spectral methods
- Counter crossover and interference data (GPC)
- Analogous data for appropriate QC samples
- Calculated results, propagated errors, detection limits

C21-002-92

EXHIBIT 12. RADIOCHEMICAL QUALITY ASSURANCE SUPPORT DOCUMENTATION (Cont'd)

Instrument Data:

Performance Data

- Instrument backgrounds
- Efficiency checks
- Check source documentation
- Energy calibration/resolution checks (spectrometry)
- Plateau checks (gas proportional counters)
- Logs and control charts of these data
- Acceptance criteria
- Corrective actions taken and the bases for same

Instrument Calibrations

- Standards preparation and traceability
- Calculation of efficiencies
- Supporting counting data
- Quench correction curves (LSC)
- Acceptance criteria
- Efficiency vs Energy curves (HRGS or NaI)
- Transmission Factor curves (GPC)
- Energy vs. Channel plots (spectrometry)
- Corrective actions taken and bases for same

Quality Control Data:

- Results and supporting raw data for scheduled blanks, replicates and refererence samples
- Results and supporting raw data for blind blanks, replicates and refererence samples
- Results and supporting raw data for participation in interlaboratory programs
- Control charts of above data
- Acceptance criteria
- Corrective actions taken and bases for same

The following procedures and supporting information may be submitted once, either at the project inception or prior to contract award:

- Official or controlled copies of all procedures used to acquire, preserve and ship samples; perform the above analyses; and calculate results
- Calculation and reporting conventions
- Algorithms used to calculate the submitted data
- Verification of software program results
- Qualifications for all analysts

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