

## **RADIOLOGICAL MONITORING AND INSTRUMENTS**

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### **1.0 SCOPE**

This Performance Assessment Guide for Radiological Monitoring and Instruments will be used to carry out the oversight responsibility of the U.S. Department of Energy (DOE) Brookhaven Group. This guide was prepared to assist in conducting performance-based assessments of both DOE prime contractors and subcontractors to ensure that their radiological monitoring and instruments programs identify, disposition, and take corrective action on issues that affect satisfactory facility performance. The goals are to ensure that laboratory employees and the public do not experience injuries and illness as a result of radiological activities and that there is little or no economic loss to the Government.

Radiological monitoring and instruments assessments will be directed at all prime contractors and subcontractors working at DOE sites. DOE line management must ensure that these contractors comply with DOE Orders and Federal and State regulations. Information developed from this assessment will determine the degree to which this is being done as well as the effectiveness of the laboratory's program.

### **2.0 ATTRIBUTES AND LINES OF INQUIRY**

This section provides lines of inquiry to help assess whether the laboratory has implemented a program that ensures that radiological monitoring and instruments requirements are incorporated into line activities. This section will be used to evaluate the laboratory's line organization.

**2.1** The laboratory has established and implemented criteria for performing radiation surveys.

- Is a documented radiation monitoring program that includes the frequency and location for radiation surveys in place?
- Are surveys performed before, during, and at the completion of work that has the potential for causing changes in levels of radiation and radioactivity?
- Are documented procedures available and is training conducted to ensure that routine dose-rate and contamination surveys are conducted in a manner that is consistently repeatable in terms of location, use of smears, and instrument interpretation?
- Are surveys properly performed by qualified personnel?

- Are procedures and criteria for completion of survey forms, acceptable radiation levels, evaluation of survey results, and reporting of off-standard survey results available?
- Are dose-rate values established for posting radiation areas? Are dose rates posted?

**2.2** The laboratory has identified and established criteria for area radiation monitoring.

- Are facility area monitoring readouts and alarms adequate to inform workers of workplace radiation levels?
- Are the numbers and locations of fixed instruments adequate to assess accident conditions? (Fixed instruments should not be affected by elevated background radiation, and the readout should be accessible.)
- Do fixed instruments alarm at a central location as well as at the instrument location?
- Are the exact locations of fixed instruments documented (e.g., 1 meter above floor) so that the shielding effect can be calculated from drawings and the exposure rate in nearby locations estimated in the event of a serious accident (i.e., a criticality accident)?

**2.3** The laboratory has established and implemented criteria for performing contamination surveys.

- Do contamination survey techniques include the capability to differentiate between fixed and removable contamination?
- Are criteria established for conducting contamination surveys under emergent conditions, such as when piping is encountered during excavation?
- Are contaminated or potentially contaminated areas adequately surveyed, documented, and posted at specific frequencies, based on the contamination levels, traffic patterns, and occupancy levels?
- Are routine contamination surveys conducted in areas that are not normally contaminated? Is the frequency of those surveys commensurate with the potential for contamination and with the significance of finding contamination in a particular area?
- Are surveys for release of materials conducted in accordance with DOE regulations?

**2.4** The laboratory has identified and established criteria for airborne radioactive material monitoring.

- Is air sampling and monitoring equipment used? Is the equipment appropriate for the nature of the operation and sources?
- Are the nominal flow rates and sampling intervals used by the organization for grab sampling, continuous sampling, personal sampling (i.e., breathing zone), air monitoring, and emergency equipment based on appropriate technical criteria?
- Are the action levels, investigation levels, and maximum permissible concentrations used based on appropriate technical criteria to evaluate air sampling and monitoring results?
- Are the minimum detection limits or minimum detectable activities for the specific radionuclides of interest provided? Do the detection levels provide optimum worker protection, and are they appropriate for established action levels? Are investigation levels and maximum permissible concentrations documented?
- Is air-monitoring equipment capable of detecting 1 Derived Air Concentration when averaged over 8 hours under laboratory conditions?
- Is a documented, acceptable air sampling and monitoring program in place? Is the program supported by sufficient studies of air flow patterns, particle size distribution, etc.?
- Is breathing zone portable sampling performed properly? Are the results of breathing zone sampling compared with area air sampling?

**2.5** The laboratory has identified and established criteria for instrumentation inspection, calibration, and testing.

- Do routine air monitor calibrations include minimum detectable activity; energy dependence; efficiency; precision, response time, stability, alarm thresholds; accuracy and stability; air flow accuracy and stability; air in-leakage, and effects of temperature, humidity, and ambient pressure?
- Are calibration procedures and frequency for the air sampling and monitoring equipment based on appropriate technical criteria? Are calibrations performed properly?
- Are appropriate radiation detectors used to analyze air samples?
- Is adequate counting equipment for filters available? Is the equipment properly calibrated and maintained? Are counting procedures available and followed by technicians? Are adequate records maintained to permit QA/QC verification of sample

- results? Are corrections for counting losses due to absorption and/or backscatter within filters made for alpha and beta radiation?
- Are corrections for radon daughter-product interference made?
  - Are procedures for the calibration of air monitors documented? Do the procedures include source check, stability check, electronics check, and air flow calibration? Are procedures for the calibration of air monitors followed?
  - Is instrumentation calibration consistent with DOE regulations?
  - Are instrument calibration sources traceable to the National Institute of Standards and Technology?
  - Is the selection of instrumentation based on objective criteria (such as performance standards and site requirements)? Are selected instruments acceptance-tested against those criteria to ensure that they are satisfactory? Are the results of those tests documented?
  - Are instruments properly tested and calibrated periodically? Are adequate records of servicing and calibration maintained?
  - Are technically based criteria used to determine the frequency of calibration and tests for operation?
  - Do instruments have current calibration stickers with appropriate correction factors? Is an adequate system for instrument recall established?

**2.6** The laboratory has identified and established criteria for maintenance of instrumentation used in radiological surveys.

- Are approved filter or sample media used when obtaining samples?
- Are operational checks of continuous air-monitoring equipment performed daily?
- Is a program established for the calibration of instruments following preventive or corrective maintenance?
- Is the complement (number and types) of instruments adequate to meet the needs of both the routine and nonroutine radiation protection surveillance program? Is the complement of instruments appropriate for the activities and radiation sources present?

- When there are special conditions, such as radio-frequency fields and magnetic fields, that require special instruments, are the instruments tested to ensure a lack of susceptibility to these factors?
- Is an adequate supply of instruments that will operate up to anticipated accident condition radiation levels available?
- Are adequate check sources available and used for both emergency and routine instruments to ensure they operate properly prior to use?
- Are "extendable" detectors available for remote monitoring under accident conditions?
- Are procedures available for workers to determine whether instruments such as hand and shoe counters are operating?

**2.7** The laboratory has identified and established criteria for radiological instrument calibration facilities.

- Does the site/facility have adequate arrangements for decontamination of operative and inoperative instruments?
- Does the calibration facility (onsite or vendor) have well-characterized dose-rate profiles of the full range and type of sources needed to calibrate instruments for the situations encountered in the facility or at the site? Are the dose-rate profiles periodically quality-control checked?
- Does the instrument repair facility have adequately trained personnel and facilities to service the instruments in use promptly and safely?
- Are methods established to periodically test overload response, temperature, sensitivity, linearity, and stability?

**2.8** The laboratory has identified and established criteria for review and approval of radiological surveys and monitoring.

- Are the results of radiation surveys and monitoring activities routinely reviewed by the radiological supervisor?
- Does the laboratory have a consistent and defensible method of correcting errors or omissions in radiological surveys (notification of affected personnel, revision of procedures)?

### **3.0 STANDARDS AND REQUIREMENTS**

#### **3.1 Specific DOE Orders and Directives.**

- DOE O 440.1A, "Worker Protection Management for DOE Federal and Contractor Employees."
- DOE 5400.5, "Radiation Protection of the Public and the Environment."
- DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards."
- DOE 5700.6C, "Quality Assurance."
- DOE/EH-0256T, "U.S. Department of Energy Radiological Control Manual Rev. 1."
- DOE P441.1, "Department of Energy Radiological Health and Safety Policy."

#### **3.2 Title 10 CFR Requirements.**

- 10 CFR 830.120, "Quality Assurance Requirements for DOE Nuclear Facilities"
- 10 CFR 835, "Occupational Radiation Protection."

#### **3.3 Other Codes and Standards.**

- ANSI N323A, "Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments."
- ANSI N42.17A, "Performance Specifications for Health Physics Instrumentation - Portable Instrumentation for Use in Normal Environmental Conditions."
- ANSI N42.17C, "Performance Specifications for Health Physics Instrumentation - Portable Instrumentation for Use in Extreme Environmental Conditions."

### **4.0 GUIDANCE TO ASSESSOR**

This assessment guide is intended to assist in conducting a performance assessment of radiological controls. It is not to be considered as all-inclusive, inflexible, or limiting reasonable assessment concentration when lines of inquiry responses dictate that an area must be more thoroughly probed.

The attributes of a comprehensive program are provided above as lines of inquiry regarding procedures, managers, training, and the like, and should give the assessor some insight as to whether there is a working program in place. Talking to the radiological workers themselves will

let you know if they feel safe working in radiological monitoring and instruments and if they feel the controls are adequate.