

**INSPECTION TECHNICAL PROCEDURE**

**I-141**

**EXTERNAL DOSIMETRY ASSESSMENT**

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Revision 1

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# INSPECTION TECHNICAL PROCEDURE I-141, REV. 1

## EXTERNAL DOSIMETRY ASSESSMENT

### 1.0 PURPOSE

This procedure assesses elements of the Contractor's Radiological Control Program (RCP) addressing external dosimetry. This guidance is based on the requirements in the Radiation Protection Program (RPP), the Safety Requirements Document (SRD), Quality Assurance Manual (QAM), Preliminary Safety Analysis Report, and the Integrated Safety Management Plan (ISMP).

This inspection procedure assesses the adequacy and effectiveness of the following:

- External dosimetry technical basis
- External dosimetry implementing procedures
- Area monitoring program
- Individual monitoring
- External dose evaluations
- Records system.

**NOTE: This procedure references RPP sections as the basis of many of the requirements. At the time of its writing, the RPP was approved for design and construction. When the revised RPP is approved for operations, this procedure will be reviewed to ensure the inspection attributes and references are appropriate.**

### 2.0 OBJECTIVES

The procedure verifies the Contractor's development and implementation of an effective external dosimetry program to ensure: (1) personnel are adequately monitored for external radiation exposure, and (2) dose is properly determined and recorded.

This procedure is a component of the RCP inspection program. This and other inspection procedures will be used on an on-going basis, as needed, to provide assurance dose from external sources of radiation is being measured and recorded as required by the RCP, authorization basis commitments, and Contractor procedures. This procedure will be used throughout the entire life cycle of the River Protection Project Waste Treatment and Immobilization Plant (WTP). However, the entire inspection procedure may not be completed during any one inspection and/or every time the inspection procedure is used.

### **3.0 INSPECTION REQUIREMENTS**

#### **3.1 Adequacy and Effectiveness of External Dosimetry Technical Basis**

The inspector should verify the Contractor's determination of the physical characteristics of the radiation field in support of the design for the external monitoring program and in the evaluation of external dose. (RPP, Requirement 44)

#### **3.2 Adequacy and Effectiveness of External Dosimetry Implementing Procedures**

The inspector should verify the Contractor's preparation, review, and approval of procedures to implement its external dosimetry program. (RPP, Requirements 22 and 45; and QAM, Policy Q-05.1)

#### **3.3 Adequacy and Effectiveness of Area Monitoring Program**

The inspector should verify the Contractor's implementation of elements of its radiation monitoring and control program specifically support external dosimetry. (RPP, Requirements 44, 45, and 60)

#### **3.4 Adequacy and Effectiveness of Individual Monitoring**

The inspector should verify the Contractor's implementation of its external dosimetry procedures. (RPP, Requirement 22; and QAM, Policy Q-05.1)

#### **3.5 Adequacy and Effectiveness of External Dose Evaluation**

The inspector should verify the Contractor's implementation of its external dose evaluation procedures. (RPP, Requirements 22 and 45; and QAM, Policy Q-05.1)

#### **3.6 Adequacy and Effectiveness of Records**

The inspector should verify the Contractor's preparation and maintenance of records to support the external dosimetry program. (RPP, Requirements 76 through 87, and 94; and QAM, Policy Q-17.1)

### **4.0 INSPECTION GUIDANCE**

Guidance is provided to assist the inspector in addressing the inspection requirements in Section 3.0 of this procedure.

The inspector should review the applicable parts of the authorization basis. The inspector should also be familiar with the content of the documents listed in Section 5.0, References.

Note: The Contractor is not committed to the U.S. Department of Energy (DOE) implementation guidance for external dosimetry (DOE G 441.1-4); however, this document provides useful information describing an effective external dosimetry control program.

The guidance below includes suggested sample sizes of documents and records to be reviewed, and personnel to be interviewed. The inspector may choose a different sample size based on the life cycle of the facility, the initial observations in any area, or previous inspection reports. The samples should be of sufficient size to provide confidence so the inspector can conclude if: (1) the Contractor has established and implemented an adequate and effective external dosimetry program, (2) records are being created and maintained demonstrating compliance with the requirements and allow future verification or reassessment of the recorded doses, and (3) any dose limits have been exceeded.

#### **4.1 Adequacy and Effectiveness of External Dosimetry Technical Basis**

To determine if the Contractor has adequately and effectively established the technical basis for its external dosimetry program, the inspector should:

4.1.1 Review RCP program documentation to determine if a technical basis document (TBD) has been developed for the external dosimetry program to provide (or provide reference to) the regulatory, scientific, and technical foundation of the program. See Article 512 of the Waste Treatment Plant Radiological Control Manual (WTPRCM). The technical basis should include the following:

- The methods used for evaluating external doses from workplace and individual monitoring data, and the technical basis for those methods.
- Justification of categories selected for participation in and exception from DOE Laboratory Accreditation Program (LAP) personnel dosimeter performance testing.
- QA procedures for dosimeters outside of the DOE LAP testing protocol.
- The physical characteristics of external radiation to be monitored, methods for calculating external doses, methods for documenting calculations, dose evaluation quality assurance, and procedures for recording and reporting external dose results.
- The methodology used in determining the dose of record when multiple dosimeters are used and when dosimeters are relocated.

- Individual monitoring methods, lower limits of detectability, and monitoring intervals, along with a rationale or justification for the methods and intervals chosen.
- Calibration models, parameters, assumptions, and default values used in dosimetric modeling and evaluation.
- Methods to determine external dose from exposure to immersion in semi-infinite clouds of airborne radioactivity.
- Statistical methods for evaluating dosimeter data, using appropriate controls, identifying above-background values, and analyzing trends. (RPP, Requirements 44 and 84)

4.1.2 Verify by record review a DOE LAP application for accreditation has been developed consistent with the TBD and submitted, dosimeter performance testing completed, site assessment performed, necessary corrective actions completed, and accreditation awarded.

#### **4.2 Adequacy and Effectiveness of External Dosimetry Implementing Procedures**

The inspector should review the RCP to identify those procedures addressing external dosimetry. If those procedures have not been reviewed pursuant to Inspection Technical Procedure (ITP) I-140, "RCP Programmatic Assessment," and found to contain all the required elements from the authorization basis, then the inspector should:

4.2.1 Verify the procedures are consistent with the TBD, address the following topics related to implementing an external dosimetry program, and contain sufficient direction to meet the requirements expressed in RPP, Requirements 22, 45, and 46; WTPRCM; and QAM, Policy Q-05.1:

Note: Requirements 136 and 137 are currently not applicable to the WTP, since there are no installations possessing sufficient quantities of fissile material to potentially constitute a critical mass.

- If the Contractor elects to use a DOE LAP vendor, the procedures should at the minimum address: procurement, transmission of TBD information, verification of periodic certifications, raw data retention, processing and reporting of routine and non-routine results, quality assurance checks, audits, and record creation, correction, and retention.
- If the Contractor is DOE LAP certified and performs its own dosimeter processing, then the topics required by the certification authority must be implemented.

- Procurement, testing, calibration, and evaluation of dosimetry not accredited by DOE LAP.
- Identification of those individuals provided accident dosimetry and emergency response dosimetric equipment.
- Dosimetry selection and placement criteria.
- Methods for issuance, use, control, collection, and processing of dosimeters consistent with the TBD.
- Special dosimetry issue, use, evaluation, and reporting for dose monitoring situations such as when associated with non-uniform radiation fields, and exposures to the eye, skin, extremity, fetus/embryo, minors, and members of the public.
- Instructions for lost, damaged, or contaminated dosimeters.
- Evaluation of dosimeter results including comparison of other dosimetry and radiation monitoring results, and the TBD estimated doses.
- Use of dose calculation methods described in the TBD.
- Performance measures for data quality and instructions on actions when data does not meet quality requirements.
- Methods for providing the review and approval of data.
- Reporting of exposure results and other reports.
- Trending of radiological performance measures and deficiencies.
- Determination of prior dose, planned special exposures, and emergency exposures.
- Audits of external dosimetry.

4.2.2 Perform the following steps if ITP I-140 inspection reports describe the external monitoring procedures as being adequate or if this procedure has been previously performed.

4.2.2.1 Select five procedures and verify the procedures continue to ensure requirements from the authorization basis will be implemented.

4.2.2.2 Review the results of Contractor audits or assessments performed since the last inspection. Follow-up selected identified deficiencies to determine if corrective actions were taken, if

they were effective, and if the auditors found the external dose monitoring program to be adequate.

4.2.2.3 Verify any changes made to the procedures are reviewed and approved consistent with QAM, Policy Q-06.1.

4.2.2.4 Determine based on the following observations from 4.3 through 4.5, if the procedures ensure an effective external dosimetry program.

### **4.3 Adequacy and Effectiveness of Area Monitoring Program**

In addition to the guidance below, the inspector should use ITP I-143, "Radiation Monitoring and Control Assessment," Section 4.2, to evaluate most aspects of area monitoring required by the RPP:

4.3.1 To further assess the adequacy and effectiveness of area monitoring as it applies to external dosimetry the inspector should: (WTPRCM, Articles 514 and 515)

4.3.1.1 Review the results of passive area monitors, like thermoluminescent dosimeters (TLD) used by the Contractor, to validate its decision to not provide external dosimetry to certain individuals.

4.3.1.2 Review records used by the Contractor to demonstrate the dose to members of the public in controlled and unrestricted areas is less than regulatory limits.

4.3.1.3 Where installed, active radiation monitoring equipment is used to monitor areas and alert workers to changes in exposure rate. Review the detector location, set-point determination, etc., to determine if the system is likely to achieve its intended function. For example, areas within the facility which could become high radiation areas, as a function of process activities, might be equipped with an alarming radiation monitor, indicating the need for supplemental dosimetry as required by RPP, Requirement 60 and WTPRCM Article 513.

4.3.1.4 Review the results of periodic monitoring to confirm appropriate posting of radiological areas and radioactive material areas as required by 10 CFR 835.603 are maintained.

4.3.1.5 Review the results of ongoing monitoring performed to support and maintain the TBD.

4.3.1.6 Observe use of remote area monitors to control the exposure to individuals or groups of individuals involved in activities resulting in significant dose accumulation; determine if the radiation monitors have been calibrated or corrected to respond in a similar fashion as the external dosimeters worn by the individuals; and confirm by record review both the remote monitors and supplemental dosimeters are capable of measuring the types, levels, and energies of the radiation encountered.

4.3.1.7 Determine, based on the above observations, if the procedures are adequate to ensure an effective external dosimetry program.

#### 4.4 Adequacy and Effectiveness of Individual Monitoring

To determine the adequacy and effectiveness of individual monitoring, the inspector should perform the following:

4.4.1 Tour the controlled and accessible portions of the radiological areas with a representative of the radiation protection organization to observe issue, use, and storage of external dosimetry; and verify implementation of the RCP external dosimetry implementing procedures paying particular attention to matters possibly affecting the veracity of the individuals' dose results such as:

- Failure to wear dosimetry.
- Wearing of another person's dosimetry.
- Storage of dosimeters at other than the designated storage location.
- Improper wearing of dosimetry such that the highest entry dose to the area of concern is not being measured. For example:
  - A TLD with its windows facing the body when exposed to a source of shallow dose exposure.
  - An extremity TLD on the hand with the chip facing away from the source.
  - A TLD behind a shield as could occur if the badge is worn at the waist while working in front of a hood and is shielded by the hood.
  - A TLD on the chest when the source is overhead or from behind the individual.
- Failure of the wearer to monitor their TLD for contamination when leaving a contaminated area.
- Failure to wear supplemental dosimetry when required by the Radiation Work Permit or during access to high or very high radiation areas.

4.4.1.1 If the Contractor is using a vendor to process its external monitoring instruments, the inspector should observe implementation of its collection and shipment procedure to verify the following:

- All badges are accounted for.
- Accountability is maintained.
- Contamination is checked.

- Information is provided consistent with the TBD to ensure the correct algorithms and assignments of dose are made.

4.4.1.2 If the Contractor is processing its own external dosimetry, the inspector should verify collection procedures are followed, and the dosimeters are processed in accordance with the implementing procedures.

4.4.1.3 If non-DOE LAP approved dosimetry is used, the inspector should observe its processing to confirm implementing procedures are followed.

4.4.1.4 The inspector should review implementation of the dosimetry quality control procedures to determine if the procedures are followed and what actions are taken to resolve discrepant results.

4.4.1.5 The inspector should determine based on the above observations, if the procedures are adequate to ensure an effective external dosimetry program.

#### **4.5 Adequacy and Effectiveness of External Dose Evaluation**

The goal of this inspection element is to determine if the Contractor's implementing procedures are adequate and effective in ensuring the veracity of external dosimetry results, combining these results with internal dose equivalents when appropriate, and comparing the total effective dose equivalent against the various limits and reporting requirements. (RPP, Requirements 23 through 27 and 35 through 40)

The inspector should verify adequacy and effectiveness of the Contractor's efforts to quantify external dose through conduct of the following activities:

4.5.1 Scan the dosimetry reports since the last inspection and other dose reports resulting from dosimeter processing to determine if the Contractor's procedures requiring further evaluation of doses have been implemented. Examples of doses requiring further evaluation include:

- Any dose in excess of a regulatory limit as specified in the RPP.
- Any dose in excess of the administrative control levels.
- Any dose measured by supplemental dosimeters significantly different than measured by the "dosimeter of record". (WTPRCM, Article 513)
- Skin contamination likely to result in a shallow dose of more than 100 mrem.
- Any area dosimeter indicating a significant change in exposure rate in the area it monitors.

- Any quality control dosimeter resulting in reported dose outside the acceptance criteria.

4.5.1.2 Select about 10 dose evaluations, if possible, and determine if the results of the Contractor's evaluations are consistent with current guidance such as DOE G 441.1-4.

4.5.1.3 Determine based on the above observations if the procedures are adequate to ensure an effective external dosimetry program. If procedures appear to need improvement, discuss the matter with the Radiation Protection Manager (RPM) or designee in an attempt to reach agreement if the procedures are a causal factor in deficient performance.

4.5.2 Determine by record review and observation if the Contractor's procedures for summation of internal and external dose are being correctly implemented and the results reported. Identify, if possible, three individuals receiving external dose of more than 100 mrem in a year and also internal exposure resulting in a committed effective dose equivalent of more than 100 mrem, and verify the Contractor's procedure resulted in reporting the proper total effective dose equivalent.

Note: Verify any dose in excess of the limits presented in 10 CFR 835.202, .204, and .206 through .208 were reported, as specified in 10 CFR 835.801. (RPP, Requirement 100)

4.5.2.1 Verify by record review and observation when possible, implementation of the Contractor's procedures for receipt, review, notification, and reporting of dose results.

#### **4.6 Adequacy and Effectiveness of Records**

ITP I-151, "RCP Documents, Records, and Reports Assessment," and QAM inspections will routinely address the adequacy of the Contractor's radiological program records management system. During this inspection, the inspector should confirm documents, records, and reports used, related to external dosimetry, meet the technical and regulatory requirements. No additional records need be reviewed to establish the effectiveness of the external dosimetry records.

### **5.0 REFERENCES**

10 CFR 835, "Occupational Radiation Protection," *Code of Federal Regulations*, as amended.

CH2M Hill letter from J. O. Honeyman, to William J. Taylor, ORP, "CH2M Hill Hanford Group, Inc., Response to the Office of Safety Regulation Questions Regarding The Radiation Protection Program, Revision 5A," CCN 017637C, dated January 24, 2001.

DOE G 441.1-4, *External Dosimetry Program Guide*, U.S. Department of Energy, 1999.

RL/REG-98-26, *Inspection Technical Procedures*, U.S. Department of Energy, Office of River Protection, 2001.

ITP I-140, "RCP Programmatic Assessment"

ITP I-143, "Radiation Monitoring and Control Assessment"

ITP I-151, "RCP Documents, Records, and Reports Assessment"

*Integrated Safety Management Plan*, 24590-WTP-ISMP-ESH-01-001, Rev. 3, Bechtel National, Inc., 2003.

*Quality Assurance Manual*, 24590-WTP-QAM-QA-01-001, Rev. 4, Bechtel National, Inc., 2003.

*Preliminary Safety Analysis Report to Support Construction Authorization*, 24590-WTP-PSAR-ESH-01-001, Bechtel National, Inc.

*Safety Requirements Document*, 24590-WTP-SRD-ESH-01-001-02, Volume II, Rev. 2h, Bechtel National, Inc., 2003.

*Radiation Protection Program for Design and Construction*, 24590-WTP-RPP-ESH-01-001, Rev. 0, Bechtel National, Inc., 2001.

*Waste Treatment Plant Radiological Control Manual*, 24590-WTP-MN-ESH-01-001, Rev. 1, Bechtel National, Inc., 2002.

## 6.0 LIST OF TERMS

ALARA	as low as is reasonably achievable
BNI	Bechtel National Inc.
DOE	U.S. Department of Energy
ISMP	Integrated Safety Management Plan
LAP	Laboratory Accreditation Program
NRC	U.S. Nuclear Regulatory Commission
ORP	Office of River Protection
QAM	Quality Assurance Manual
RCP	Radiological Control Program
RPP	Radiation Protection Program
RPM	Radiation Protection Manager
RWP	Radiation Work Permit
SC	Safety Criterion
SRD	Safety Requirements Document
TBD	Technical Basis Document
TLD	thermoluminescent dosimeter
WTP	Waste Treatment and Immobilization Plan

Attachments: None