

INSPECTION TECHNICAL PROCEDURE

I-142

INTERNAL DOSIMETRY ASSESSMENT

June 21, 2001
DRAFT

This procedure was written based on in-process revisions to the RPP and the QAM, and on anticipated revisions to several other authorization basis documents that were necessary to bring them in line with the new RPP. Requirements that are typed in **BOLD** will be reviewed once these authorization basis documents have been changed, and following corrections, if needed, this procedure will be issued as Revision 0.

Approved: _____ Date: _____
Verification and Confirmation Official

Concur: _____ Date: _____

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INSPECTION TECHNICAL PROCEDURE I-142, DRAFT INTERNAL DOSIMETRY ASSESSMENT

1.0 PURPOSE

This procedure provides guidance for assessing elements of the Contractor's Radiological Control Program (RCP) that address internal dosimetry. This guidance is based on the requirements in the Radiation Protection Program (RPP), Safety Requirements Document (SRD), Quality Assurance Manual (QAM), and the Integrated Safety Management Plan (ISMP).

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

- Internal dosimetry technical basis
- Internal dosimetry implementing procedures
- Air monitoring and contamination control
- Individual monitoring
- Internal dose evaluations
- Respiratory protection
- Records.

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

This procedure verifies the Contractor's development and implementation of an effective internal dosimetry program to ensure: (1) personnel are adequately monitored for internal radiation exposure, and (2) dose is properly determined, controlled, 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 necessary, to provide assurance that dose from internal 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 Plant (RPP-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 Internal Dosimetry Technical Basis

The inspector should verify the Contractor's identification of the physical characteristics of the radioactive material present within the facility and the equipment, and methods and procedures necessary to ensure internal dose is monitored and maintained within regulatory limits. (RPP, Requirements 44, 48, 49, and 50)

3.2 Adequacy and Effectiveness of Internal Dosimetry Implementing Procedures

The inspector should verify the Contractor's preparation, review, and approval of procedures to implement its internal dosimetry program. (RPP, Requirements 22 and 47; and **QAM, Policy Q-05.1**)

3.3 Adequacy and Effectiveness of Air Monitoring and Contamination Control

The inspector should verify the Contractor's implementation of elements of its air monitoring and contamination control program that specifically support internal dose assessment and control. (RPP, Requirements 41, 42, and 114 through 121)

3.4 Adequacy and Effectiveness of Individual Monitoring

The inspector should verify the Contractor's implementation of its internal dosimetry procedures. (RPP, Requirements 22 and 47)

3.5 Adequacy and Effectiveness of Internal Dose Evaluation

The inspector should verify the Contractor's implementation of its internal dose evaluation procedures. (RPP, Requirements 23 through 27, and 36 through 42; and **QAM, Policy 05.1**)

3.6 Adequacy and Effectiveness of Respiratory Protection

The inspector should verify the Contractor's implementation of its respiratory protection program. (SRD, Safety Criterion (SC) 5.1-2)

3.7 Adequacy and Effectiveness of Records

The inspector should verify that records have been prepared and maintained to support the internal dosimetry program. (RPP, Requirements 76 through 86; **QAM, Policy 17.1**; and ISMP, Section 8.0, Table 8-1)

4.0 INSPECTION GUIDANCE

Guidance is provided to assist the inspector in addressing the inspection requirements set forth 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: While the Contractor is not committed to the DOE implementation guidance for internal dosimetry (DOE G 441.1-3), this document provides useful information describing an effective internal 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, on the initial observations in any area, or on information provided in 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 internal dosimetry program, (2) any dose limits that have been exceeded are identified, and (3) records created and maintained demonstrate compliance with the requirements and allow future verification or reassessment of the recorded doses.

4.1 Adequacy and Effectiveness of Internal Dosimetry Technical Basis

The inspector should review RCP program documentation to determine if a technical basis document (TBD) has been developed for the internal dosimetry program describing the regulatory, scientific, and technical foundation of the program. The technical basis should include: (RPP, Requirement 48)

- A description of the physical characteristics of the radionuclides present within specific areas of the facility as necessary to evaluate intake, uptake, and calculate dose
- A detailed description of the bioassay program or documents contracting with a vendor to provide DOELAP certified bioassay services
- The criteria for individual and area air sampling programs to supplement bioassay methods
- The methods used for evaluating internal doses from bioassay, workplace, and individual monitoring data
- A description of actions to reduce significant intakes of radioactive material
- The methodology used in determining the dose of record when the results from bioassay, workplace, or individual monitoring do not agree

- Statistical methods for evaluating data, using appropriate controls, identifying above-background values, and analyzing trends
- Quality assurance and quality control procedures for ensuring that bioassay and air sample results are consistently accurate and that the DOELAP testing protocol is maintained if a vendor is used.

Note: While the Contractor is not committed to DOE-STD-1121-98, Section 3.1, "Internal Dosimetry Technical Basis Documentation," contains guidance useful in evaluating the TBD.

4.2 Adequacy and Effectiveness of Internal Dosimetry Implementing Procedures

The inspector should review the RCP to identify those procedures that address internal dosimetry. Review the selected procedures using the following guidance:

4.2.1 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 safety elements from the authorization basis, then the inspector should:

4.2.1.1 Verify the procedures are consistent with the TBD and contain sufficient direction to meet the requirements expressed in **QAM, Policy Q-05.1**. The procedures should at least address the following: (RPP, Requirements 22, 47, and 48)

- When the Contractor elects to use a DOELAP vendor, the procedures should address: the procurement process, transmission of TBD information, verification of periodic certifications, raw data retention requirements, processing and reporting of routine and non-routine results, quality assurance checks, audits, and record creation, correction, and retention
- If the Contractor elects to become certified to perform its own bioassay processing, then the procedures required by the certification authority must be implemented plus the topics noted in the preceding bullets
- A system to identify those individuals that must have their internal dose assessed and the frequency of assessment in order to comply with the RPP
- A system to identify what type of bioassay methods or air sampling to be used for individuals during routine and non-routine events
- Methods for notification of bioassay, issuance of sampling equipment, instructions on use of sampling equipment, control and collection of samples, and processing of samples

- Special bioassay procedures for issue, use, evaluation, and reporting of situations like exposure to a fetus/embryo, minors, or members of the public within the controlled area and during emergencies
- Special instructions for collection of samples or performing in vivo bioassay measurements when the individual is contaminated
- Performance measures for data quality and instructions on actions when data does not meet quality requirements. See American National Standard Institute, *Performance Criteria for Radiobioassay*, HPS (Health Physics Society) N13.30-1996 for guidance
- Evaluation of bioassay results, including comparison with other individual bioassay results, and individual air monitoring or area air monitoring results
- Trigger levels and actions to be taken based on initial sample results
- Use of dose calculation methods described in the TBD
- Provide for the review and approval of results
- Identification of doses in excess of administrative or regulatory limits and reporting requirements
- Trending of performance measures and deficiencies
- Determination of prior dose, planned special exposures, and emergency exposures
- Audits of internal dosimetry.

4.2.2 If prior ITP I-140 related inspection reports describe the internal monitoring procedures as being adequate or if this procedure has been previously performed then perform the following steps:

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

4.2.2.2 Review the results of 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 internal dose monitoring program to be adequate.

4.2.2.3 Verify that any changes made to the procedures were reviewed and approved consistent with **QAM, Policy Q-06.1, Document Control**.

4.2.2.3 Determine based on observations from 4.3 through 4.6 that follow, if the procedures are adequate to ensure an effective internal dosimetry program.

4.3 Adequacy and Effectiveness of Air Monitoring and Contamination Control

The inspector should use ITP I-144, "Air Monitoring Program Assessment," and/or ITP I-145, "Contamination Monitoring and Control Assessment," to assess most aspects of air monitoring and contamination control required by the RPP.

To further assess the adequacy and effectiveness of air monitoring and contamination control as it applies to internal dosimetry, perform the following steps: (RPP, Requirements 40, 43, 44, 45, 49, and 117 through 121)

- 4.3.1 The inspector should: (1) select two air monitors and two air samplers being used to control the exposure to individuals or groups of individuals involved in activities that might result in significant airborne exposure, (2) determine if the air monitors or sampling equipment have been calibrated and are operating properly, and (3) confirm by record review that the air monitors and air sample counting equipment are capable of measuring the type, level, and energies of the radioactive material encountered. In those situations where installed active air monitoring equipment is used to monitor areas and alert workers to changes in airborne concentrations of radioactive material, review the detector location, set-point determination, etc, to determine if the system is likely to achieve its intended function.
- 4.3.2 The inspector should review the results of selected air samplers (including lapels) and continuous air monitors (CAMs) to determine if individuals may have been exposed in excess of 40 derived air concentration hours (DAC-Hrs) in one year. If it appears that individuals could have received this level of exposure, verify their internal dose was assessed in accordance with TBD procedures.
- 4.3.3 The inspector should select, if possible, about 10 individuals required to be monitored for internal exposure who actually received dose in excess of 100 mrem committed effective dose equivalent. Review the Contractor's comparison of bioassay results to air concentrations. If the Contractor did not compare the results, select one or two and perform a rough comparison based on the information available. The purpose of the comparison is to determine if dose recorded for the exposure is consistent with the measured airborne activity in the individual's work area. Generally, for dose at a small fraction of the 5 rem committed effective dose equivalent (<1 rem), agreement within a factor of 2 would be excellent but failure to agree within a factor of 5 would warrant further evaluation; see HPS N13.30-1996, Section B-6 for specific guidance.
- 4.3.4 The inspector should review the results of periodic contamination monitoring to confirm the Radiation Control Zones presented in Table 5.5 of the Initial Safety Analysis Report are maintained and the re-suspension factor is validated based on air sample and bioassay results.
- 4.3.5 The inspector should observe if possible, work involving airborne radioactivity to determine if the workers intake of radioactive material is being monitored by air sampling or air monitoring equipment. Determine if the air sampling or monitoring is representative of the workers breathing zone; if not, confirm the workers are participating in the bioassay program.

4.4 Adequacy and Effectiveness of Individual Monitoring

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

- 4.4.1 The inspector should 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 bioassay sampling equipment. The inspector should verify implementation of the RCP internal dosimetry implementing procedures and pay particular attention to matters that might impugn the veracity of the individuals' dose results such as:
- Inadequate control of sampling containers
 - Inadequate instructions on sampling technique, such as timing
 - Bioassay sample collection by contaminated or potentially contaminated persons
 - Storage of samples at other than the designated storage locations
 - Improper wearing of individual air sampling equipment such that it would not be representative of the wearer's breathing zone
 - Failure of the individual to monitor for contamination before submitting to an in vivo bioassay measurement process, like a whole body count.
- 4.4.2 If the Contractor is using a vendor to process its bioassay samples, the inspector should check two batches to determine implementation of its collection and shipment procedure by verifying:
- All samples are accounted for
 - Sample accountability is maintained
 - Contamination is checked
 - Information is provided consistent with the TBD to ensure that the correct algorithms and assignment of dose are made.
- 4.4.3 If the Contractor is processing its own internal dosimetry, the inspector should select three batches to verify the collection procedure was followed as in 4.4.2, and that bioassay samples are processed in accordance with the implementing procedures.
- 4.4.4 Based on discussion with the radiation protection organization, identify, if possible, about 10 workers that are likely to receive more than 100 mrem committed effective dose equivalent, and any pregnant individuals, minors, or members of the public entering a controlled area such that they would be likely to receive uptake that could result in a dose approaching 50 mrem committed effective dose equivalent during a calendar year. From this set, the inspector should select at least five individuals and confirm they are

participants in the bioassay program by review of sample results. (RPP, Requirements 22 and 47)

- 4.4.5 The inspector should review implementation of the internal dosimetry quality control procedures since the last inspection to determine if the procedures were followed and if the bioassay program is meeting performance expectations.

4.5 Adequacy and Effectiveness of Internal 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 internal dosimetry results, combining these results with external dose equivalents when appropriate, and comparing the total effective dose equivalent against the various limits and reporting requirements. (RPP, Requirements 23 through 27 and 36 through 42)

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

- 4.5.1 Scan all the bioassay reports since the last inspection and other dose reports resulting from air sampling to determine if the Contractor's evaluation of doses was consistent with its implementing procedures. Examples of doses requiring further evaluation should include:
- Any dose in excess of a regulatory limit as specified in the RPP
 - Any dose in excess of the administrative control levels
 - Any internal dose to a declared pregnant woman, minor, or member of the public in the controlled area in excess of 50 mrem committed effective dose equivalent
 - Any quality control bioassay results outside the acceptance criteria.
- 4.5.2 Select one or two evaluations from those identified in 4.5.1 above, and determine if the results of the Contractor's evaluations are consistent with current regulatory guidance such as G 441.1-3, G 441.1-6, U.S. NRC Regulatory Guide 8.34, *Monitoring Criteria and methods to Calculate Occupational Radiation Doses*, or Regulatory Guide 8.36, *Radiation Dose to the Embryo/Fetus*, as referenced in ISAR, Section 5.11.
- 4.5.3 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 recorded. Based on a scan of all the occupational dose summary reports since the last inspection, identify any exposures that resulted in a committed effective dose equivalent of more than 0.1 rem in a year. Determine if any of those individuals also received measurable deep dose equivalent. Select three of the individuals receiving both a significant committed effective dose equivalent and the greatest amount of deep dose equivalent. Review the dose calculations for these three individuals to determine if the

TBD and implementing procedures were followed in the calculation and if total effective dose equivalent was recorded and reported.

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)

- 4.5.4 Using the three individuals selected in 4.5.3 above, verify by record review and observation when possible, if the Contractor's procedures for receipt, review, notification, and report of dose results were implemented.

4.6 Adequacy and Effectiveness of Respiratory Protection

The Contractor committed in SRD, SC 5.1-2 (9) to notify the Regulator, in writing, at least 30 days before the date that respiratory protection equipment is first used to protect workers from airborne radioactivity. It is expected that the first use of this procedure will focus on the program and subsequent inspections will focus on changes to the program and implementation. To assess the contractor's respiratory protection program, use the following guidance:

- 4.6.1 The inspector should review the Contractor's written policy statement to verify that it contains the three points presented in SRD, SC 5.1-2 (7).

4.6.1.1 The inspector should review the implementing procedures to ensure the topics presented in SRD, SC 5.1-2, items (1) through (6) and (8), and ANSI Z-88.2-1992, *American National Standard for Respiratory Protection*, have been addressed. Verify that procedures contain the specific "shall" requirements from Z-88.2 for each of the following topics: (SRD, SC 5.1-2, Implementing Codes and Standards)

- Control of occupational diseases caused by air contaminants (required to be minimized by the use of engineering controls when feasible)
- Responsibilities of the employer and employee
- Administration of the program by a single competent individual
- Physiological and psychological determinations by a physician (individuals must not have medical conditions that would preclude use of respirators)
- Respirator selection criteria
- Training
- Respirator fit testing
- Maintenance, inspection, and storage

- Emergency escape/rescue.
- 4.6.2 If past ITP I-140 related inspection reports describe the respiratory protection procedures as being adequate or if this procedure has been previously performed then:
- 4.6.2.1 The inspector should select five procedures and verify that the procedures continue to ensure that requirements from the authorization basis will be implemented.
- 4.6.2.2 The inspector should review the results of audits or assessments to determine if changes to procedures were necessary to improve performance or address procedural weaknesses.
- 4.6.2.3 The inspector should verify that any changes made to the procedures were reviewed and approved consistent with **QAM, Policy Q-06.1**.
- 4.6.3 The inspector should determine from discussions with the radiation protection organization if any work is in progress or about to occur that involves use of respiratory protection devices. If possible observe workers picking up their respiratory protective equipment, performing the fit tests, and wearing any air monitoring equipment required on the Radiation Work Permit. Confirm the following:
- Engineering controls were not feasible to reduce airborne exposure
 - The wearers were properly trained and medically approved to use respirators
 - The equipment used was appropriate for the circumstances, properly stored, and maintained
 - The equipment was inspected, donned, doffed, and used in accordance with procedures
 - The dose determined from bioassay analysis was consistent with the dose determined from airborne activity measurements and application of the respiratory protective equipment protection factor
 - The total dose was maintained as low as is reasonably achievable.
- 4.6.3.1 If no work involving use of respiratory protective equipment is available for observation, the inspector should review the records of respirator use for five individuals using the same approach as in 4.6.3, above. In addition, review the results of any audits of the respiratory protection program, performed since the last assessment, to determine if deficiencies were identified and corrected.
- 4.6.3.2 The inspector should determine, based on the above observations, if the procedures are adequate to ensure an effective respiratory protection program.

4.7 Adequacy and Effectiveness of Records

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

5.0 REFERENCES

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

ANSI HPS N13.30-1976, *Performance Criteria for Radiobioassay*, American National Standard Institute, 1996.

ANSI Z88.2-1992, *American National Standard for Respiratory Protection*, American National Standard Institute, 1992.

DOE G-441.1-3, *Internal Dosimetry Program Guide*, U.S. Department of Energy, 1999.

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

DOE G-441.1-6, *Evaluation and Control of Radiation Dose to the Embryo/Fetus Guide*, U.S. Department of Energy, 1999.

DOE-STD-1112-98, *Department of Energy Laboratory Accreditation Program for Bioassay*, U.S. Department of Energy, 1998.

DOE-STD-1121-98, *Internal Dosimetry*, U.S. Department of Energy, 1998.

DOE-STD-1128-98, *Guide of Good Practices for Occupational Radiological Protection in Plutonium Facilities*, U.S. Department of Energy, 1998.

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-144, "Air Monitoring Program Assessment"

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

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U.S. NRC Regulatory Guide 8.7, *Instructions for Recording and Reporting Occupational Radiation Exposure Data*, U.S. Nuclear Regulatory Commission, 1992.

U.S. NRC Regulatory Guide 8.15, *Acceptable Programs for Respiratory Protection*, U. S. Nuclear Regulatory Commission, 1999.

U.S. NRC Regulatory Guide 8.34, *Monitoring Criteria and Methods to Calculate Occupational Radiation Doses*, U.S. Nuclear Regulatory Commission, 1992.

U.S. NRC Regulatory Guide 8.36, *Radiation Dose to the Embryo/Fetus*, U.S. Nuclear Regulatory Commission, 1992.

6.0 LIST OF TERMS

CAM	continuous air monitor
DAC	derived air concentration
DOE	U.S. Department of Energy
DOELAP	DOE Laboratory Accreditation Program
HPS	Health Physics Society
ISMP	Integrated Safety Management Plan
ISAR	Initial Safety Analysis Report
NRC	U.S. Nuclear Regulatory Commission
QAM	Quality Assurance Manual
RCP	Radiological Control Program
RPP	Radiation Protection Program
RPP-WTP	River Protection Project Waste Treatment Plant
RPM	Radiation Protection Manager
SC	Safety Criterion
SRD	Safety Requirements Document
TBD	Technical Basis Document

Attachment: None