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Companywide	Management Control Procedure	For Additional Info: http://EDMS	Effective Date: 01/21/14
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Manual: 15B – Radiation Protection Procedures

USE TYPEChange Number: 341108

*The current revision can be verified on EDMS.

1. INTRODUCTION

1.1 Purpose

This procedure establishes the steps necessary to implement the Idaho Cleanup Project (ICP) Internal Dosimetry Program.

1.2 Scope and Applicability

This procedure covers implementation of the Internal Dosimetry Program and applies to personnel who are selected to participate in the Internal Dosimetry Program and individuals responsible for implementing the Internal Dosimetry Program.

2. PREREQUISITES

- 2.1 Personnel using this procedure are familiar with MCP-87, “Responding to Freedom of Information Act and Privacy Act Requests”, which outlines policy pertaining to the freedom of information and the privacy act program. Radiation exposure to employees must be treated as Privacy Act Information. The information may be used by the Department of Energy (DOE) and DOE contractor personnel and is for official use only. Reproduction of the information for dissemination to unauthorized personnel is prohibited. The proper designation on any dose history records is “Privacy Act Information.”
- 2.2 Individuals meet the requirements of 10 CFR 835.402(c), requiring that they participate in an internal dosimetry bioassay program, or are selected to participate in an internal dosimetry confirmatory bioassay program at the discretion of Radiological Control (RadCon) personnel.

3. INSTRUCTIONS

3.1 Internal Dosimetry Program Technical Basis Documents

- 3.1.1 Radiation Dosimetry Technical Support Manager or Designee: Prepare the ICP Internal Dosimetry Program Technical Baseline Document (TBL) consistent with the guidelines in DOE-STD-1121-98, Internal Dosimetry (Reaffirmation with Errata May 2003).
- 3.1.2 Radiation Dosimetry Technical Support Manager or Designee: Periodically, at least every 3 years, review, update and approve the ICP

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Internal Dosimetry Program TBL as needed to keep current with ICP activities and regulatory requirements.

- 3.1.3 Project RadCon Manager or Designee: Review isotopic distributions annually in accordance with MCP-6, Radiological Control Program Technical Basis and Conduct of Technical Change. Perform additional characterization as needed for changing work conditions.
- 3.1.4 Project RadCon Manager or Designee: Prepare and maintain an Internal Dosimetry Program TBL to be implemented at the facility/project for which they are responsible. The TBL should supplement the ICP Internal Dosimetry Program TBL and be developed consistent with the guidelines contained in DOE-STD-1121-98, Internal Dosimetry, (Reaffirmation with Errata May 2003). Periodically, at least every three years, review the TBL and update as appropriate. Submit the facility specific TBL and any updates to the ICP Internal Dosimetrist for review and concurrence.
- 3.1.5 Project Internal Dosimetry Coordinator (IDC): Rank source term radionuclides in terms of dose fractions. Am-241 and Pu-239 account for >95% of the committed effective dose shown in the following example.

Radionuclide	Results ⁽¹⁾ (pCi/s)	Activity Ratio (%)	Absorption Type	Dose Coefficient (mrem/pCi)	Committed Effective Dose (mrem)	Dose Fraction (%)
Am-241	4.73E+02	80.8	M	1.00E-01	4.73E+01	80.697
Pu-238	1.04E+00	0.18	M	1.11E-01	1.15E-01	0.197
Pu-239	9.38E+01	16.02	M	1.19E-01	1.12E+01	19.044
Sr-90	1.20E+01	2.05	F	1.11E-04	1.33E-03	0.002
U-235	3.22E+00	0.55	M	6.67E-3	2.15E-03	0.037
U-238	2.31E+00	0.39	M	5.93E-3	1.37E-02	0.023
	5.85E+02	100			58.6	100

(1) Assumes a worst case intake equal to the measured sample activity results.

3.2 Bioassay Program Selection

NOTE: *The radiological control practices routinely used during radiological work at the ICP are not likely to result in committed effective dose >100 mrem. Subsequently, workers selected to participate in the bioassay program are selected at the discretion of RadCon personnel constituting a confirmatory bioassay monitoring program. Project RadCon Manager or Designee: Evaluate radiological work during ALARA Committee Reviews, Radiological Control Reviews, and Health and Safety Plan (HASP) development to determine situations or conditions that subject employees to increased potential for internal radiological exposure.*

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3.2.1 Project RadCon Manager or Designee: Assess the radiological controls incorporated into work tasks and determine if a *new hire baseline bioassay (see def.)*, *job specific bioassay (see def.)*, or *periodic bioassay (see def.)* should be included. If the work is not covered by an approved facility/project specific TBL, then Form 441.29, Job Specific Bioassay Evaluation can be used to document bioassay requirements.

3.2.2 Project RadCon Manager or Designee: If work involves a HASP, identify any bioassay requirements in the plan to allow for bioassay funding and contractor knowledge/planning.

NOTE: *A newly hired employee (including subcontractor, force account and rehired individuals) who requires monitoring for radiation exposure and has worked at another radiological facility may have received an intake of radioactive material that could impact the ICP Internal Dosimetry Program. For employees who request to be issued a dosimeter, a New Hire Baseline Bioassay Screening Worksheet is used to identify when a new hire baseline bioassay is necessary and the type of bioassay needed.*

3.2.3 Project RadCon Manager or Designee: Before issuing a dosimeter to a newly hired employee, assess the need to have the individual fill out a New Hire Baseline Bioassay Screening Form 441.A10 or equivalent.

NOTE: *A completed Form 441.A10 or equivalent, New Hire Baseline Bioassay Screening worksheet, will contain Personal Identification Information(PII) that must be protected and handled where Federal agencies are required by law to ensure the protection of the Personal Identification Information that they collect, store, transmit, and retain and/or transfer information.*

3.2.4 Direct a new hire employee who will become a monitored radiation worker of the CWI contractor, and who has been a radiation worker other than at the INL site, to fill out a form 441.A10 or equivalent new hire baseline bioassay screening worksheet.

NOTE: *A new hire employee needs to provide a Security Number (S #), otherwise, a Social Security Number or Passport Number before requesting a dosimeter from a RadCon Dosimetry Coordinator.*

3.2.5 New Hire Employee: Obtain a hard copy form 441.A10 or equivalent from the RadCon organization or print a copy of the form from EDMS forms management.

3.2.5.1 Complete the employee section of the New Hire Baseline Bioassay Screening Worksheet.

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- 3.2.5.2 Return the completed form to the requesting RadCon organization or to the, project Internal Dosimetry Coordinator (IDC), listed on the form where the employee will be working.
- 3.2.5.3 If a Social Security Number or Passport Number must be used, the New Hire Baseline Bioassay Screening Worksheet is completed by the new hire employee and delivered to the IDC at the facility where the dosimeter is being requested.
- 3.2.6 Project RadCon Manager or Designee: Send completed New Hire Baseline Bioassay Screening forms to the cognizant project IDC for evaluation.
- 3.2.7 Project IDC: Upon receipt of a new hire Baseline Bioassay Screening Worksheet assess the need for any follow-up baseline bioassays,
- 3.2.7.1 Complete the IDC section of the worksheet and initiate employee notification and a bioassay request in the Sentinel bioassay management module when *in vivo* counts or *in vitro* samples are deemed necessary.
- 3.2.7.2 Upon completion, hard copy forms that are no longer needed by the Radcon project and IDC are to be send to Radiation Dosimetry and Records for filing.
- 3.2.8 Project IDC: Schedule bioassays based on the project/facility specific TBL, Form 441.29, Job Specific Bioassay Evaluation or ALARA Reviews. Notify individuals selected for participation in an appropriate manner, using Sentinel's bioassay management module to schedule and track the bioassay sampling process.
- 3.2.9 Employees who transfer to another CWI facility or project should provide a final or post job bioassay when required or upon the request of the project Radiological Engineer or IDC.

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3.3 Evaluation of Events with the Potential for Intakes

3.3.1 Project RadCon Manager or Designee: Immediately evaluate an event related potential intake and initiate appropriate *special bioassay*, if necessary.

3.3.1.1 Request isotopic analysis of the source term when there is an event where an intake by an employee is suspected. Collect and submit for isotopic analysis, samples such as contaminated smears, air filters, nasal swabs, contaminated PPE, etc.

NOTE: *The source term isotopic distribution at a facility or project is often known from process knowledge or historical records. However, a bioassay request resulting from an event needs to be verified to ensure that radionuclides that make up 95% of the source term are accounted for in an internal dose estimate.*

3.3.1.2 Restrict employee access to Contamination Areas and Airborne Radioactivity Areas if work could result in a second intake during the course of an investigation and impact the outcome of the internal dose assessment.

3.3.1.3 Interview knowledgeable employees gathering important information about the event, levels and locations of personal contamination, results of nose and mouth swabs, number of employees involved, measured airborne activity, expected source term radionuclides, etc.

3.3.1.4 Request a whole body count (WBC) when source term is tagged with high energy photon activity.

NOTE: *Requesting a WBC when the source term is tagged with high energy photon activity (i.e. Cs-137) together with measured beta, gamma, and alpha ratios allows a preliminary estimate of an acute intake. The dose estimate will be refined later through additional bioassay results.*

3.3.1.5 Control the event location to keep it undisturbed to allow for the necessary gathering of information until the event can be assessed as necessary to establish an internal dose assignment.

3.3.1.6 Promptly inform the Radiation Dosimetry Technical Support Manager or RDR Internal Dosimetry staff of any events with a significant potential for intakes so that the RDR Internal Dosimetry staff may provide assistance during event follow up.

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3.3.1.7 Counsel affected employees during the course of an investigation keeping them informed of the status of the assessment, providing an opportunity to answer questions, and helping understand the information necessary to establish any internal dose assignment.

3.4 Special Bioassay

NOTE 1: *The quantity of radioactive material in the body and in the excreta is typically highest during the first few days following an intake. Bioassays performed between 24 and 96 hours after an intake will permit detection of the smallest possible intake. Experience has shown that prompt attention also leads to accurate assessment of the intake. For these reasons, special (for cause) bioassay is performed when there is an increased risk of an intake. In general, the risk of an intake is elevated whenever containment of radioactive material is lost (i.e., radioactive material is airborne, deposited on workplace surfaces, or on the skin or modesty clothing of personnel). Once containment is lost, whether or not special bioassay is warranted depends on the quantity of material released, the duration of personnel exposure, whether or not respiratory protection and contamination control measures were used, and if the contaminant could reasonably be expected to be internally deposited.*

NOTE 2: *There are many factors that could modify the guidelines provided below. For example, the level of detail known about an occurrence, the source term involved, the magnitude of the radioactivity, etc. should all be considered by the Project IDC when making the decision to perform special bioassay. Thus, it is important to note that the following are simply guidelines and that professional judgment must be used when making determinations to follow-up with special bioassay monitoring.*

3.4.1 Project IDC: Assess the need for a special bioassay when a worker has been subjected to an upset condition where an intake is likely. An intake should be evaluated if any of the following occurs:

- A worker is exposed to airborne radioactivity in excess of 10 DAC-hrs in a quarter. This value for exposure includes use of the assigned protection factor.
- There is reason to believe that the indicated air sample concentration measurements could greatly underestimate the actual worker exposure (e.g. air sample concentration was not representative of the breathing zone concentration).
- Any detectable alpha or beta/gamma contamination measured on the upper body where an intake of the contaminant is in question.

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- Nasal swabs or mouth samples contain detectable radioactivity.

NOTE: *A negative sample does not necessarily indicate an intake has not occurred. Consider factors where the activity may have been removed before samples could be obtained or elapsed time since an intake could have occurred.*

- Evidence of an upset condition that causes one to suspect that radioactive material might have been ingested, inhaled, injected, or absorbed through the skin (e.g., CAM alarm without respiratory protection, equipment failure causing loss of containment, upset ventilation conditions, unplanned release of radioactive material resulting in contamination on accessible services, etc.).
- Individuals receive prolonged exposure to radionuclides that are being absorbed through the skin, such as tritium or radioiodine.
- Significant contamination is detected on protective clothing and no respiratory protection is in use.
- A worker incurs a wound in an area where it's possible for the radioactive contaminant to be internally deposited.
- A positive bioassay is identified.

3.5 Termination Bioassay

NOTE: *ICP trained radiological workers who terminate are identified by the RadCon organization to complete a termination bioassay. There are employee specific circumstances that could modify the guidance provided below. For example, the terminating individual has not worked as a trained radiological worker for many years and/or work performed was of low or no risk for an intake to occur. Thus, it is important to note that the following are simply guidelines and that professional judgment is to be used when requesting a termination bioassay.*

Project RadCon Manager or Designee: Evaluate the need for *termination bioassay* (see def.) for those employees terminating employment with CWI. Utilize Sentinel to help evaluate the employee's radiological work and bioassay history. Consider the need for a termination bioassay using the following as indicators;

- Review radiological work performed since the employee's last bioassay. Assess completed work and increased likelihood for potential intake.
- Records show that the individual has completed previous bioassay requests.

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- Individual is currently participating in a project's periodic monitoring bioassay program.
- Individual has a pending bioassay request awaiting compliance.
- Individual has recently participated in a project or task that the RadCon staff is asking for a termination bioassay (e.g. stipulated on Form 441.29, Job Specific Bioassay Evaluation).

3.6 Work Restrictions

NOTE 1: *The IDC keeps a file of sample notification requests that may be used as needed. Appendix A, Bioassay Program General Information Sheet is provided in each issued bioassay kit. The information sheet answers frequently asked questions and is offered to the employee as assistance in answering questions or concerns regarding internal dosimetry monitoring.*

NOTE 2: *Failure to participate with bioassay program requirements could result in inaccurate exposure reporting. It could also result in the inability to properly assess radionuclide intakes. Due to the significance of potential consequences, an employee who fails to respond or participate in the bioassay program will have access restricted to radiologically controlled areas until requested bioassays are complete.*

NOTE 3: *Duration of work restrictions should be a collaborative informed decision between the Project RadCon Manager or Designee and Project IDC using sound professional judgment. Examples of information used to make such informed decisions include isotopic analyses of air samples and smears, review of project specific internal dosimetry technical basis documents, employee exposure history, evaluation or investigation of the cause of intake and preliminary dose assessments.*

3.6.1 Project RadCon Manager or Designee: Impose individual work restrictions in Sentinel when any of the following conditions are met:

- A bioassay evaluation is pending and has the potential to cause the employee's total exposure to exceed an as low as reasonably achievable (ALARA) goal or a regulatory guide or limit, or where the pending evaluation would be complicated by any additional intakes.
- An employee has not complied with a bioassay program schedule or requirement.
- A newly hired employee needs to complete a New Hire Baseline Bioassay before beginning work in radiological areas.

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- A job specific bioassay, documented on Form 441.29, Job Specific Bioassay Evaluation that requires an initial bioassay before beginning specified work.

- 3.6.2 Project RadCon Manager or Designee: Communicate work restriction to the employee and the employee's immediate supervisor.
- 3.6.3 Project RadCon Organization: Restrict employee access to Contamination Areas and Airborne Radioactivity Areas to the extent deemed necessary until the employee has satisfied Bioassay Program requirements.
- 3.6.4 Project RadCon Manager or Designee: Maintain vigilance of bioassay requests shown in Sentinel that are soon to become delinquent or are already delinquent.
- 3.6.4.1 Review Sentinel bioassay management module and resolve any discrepancies.
- 3.6.4.2 Send an email stating the justification to the ICP Internal Dosimetrist if there is cause warranting removal of a bioassay request from Sentinel .
- 3.6.4.3 Within 7 working days of the start of each month, evaluate the status of the project's bioassay requests and notify employees and their managers of any non-compliance.
- 3.6.5 In Vitro Program Staff: Notify the impacted project of any rejected bioassay samples and any request for removal from Sentinel tracking, documenting the reason in the laboratory sample record database. Send an email stating the justification of the rejected sample to the ICP Internal Dosimetrist requesting the sample to be deleted from Sentinel.

3.7 Bioassay Evaluation

- 3.7.1 Radiation Dosimetry Technical Support Manager or Designee: Evaluate all positive bioassay results to determine their significance relative to the potential for internal exposures. As discussed in TBL-130, Idaho Cleanup Project Technical Basis Document for Internal Dosimetry, this should include *in vitro* bioassay samples with results greater 0.71 times the analytical laboratories MDA, *in vivo* bioassay counts greater than 2.33 times the standard deviation, and total uranium results in urine samples greater than 0.175 micrograms/L. The evaluation should be coordinated by the Project RadCon Manager or designee.
- 3.7.2 Radiation Dosimetry Technical Support Manager or Designee: If the evaluation indicates that the intake exceeded one Annual Limit of Intake

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(ALI), DOE standard references the recommended threshold limits based on the ALI specified in ICRP-61 standard of 2.0 rem/y, consider the need for decorporation (such as chelation) therapy/medical intervention. This must be done in conjunction with Occupational Medical Program. Refer to “TBL-171, RadCon Technical Basis for Establishing Levels of Radionuclide Intakes for Consideration of Medical Intervention” for guidance on the advisability of such actions.

- 3.7.3 Project IDC: If the evaluation results in the need for additional bioassays or the analysis of additional samples (i.e. air samples and smears) to supply information concerning isotopic content or ratios; initiate the action necessary to obtain the indicated bioassays or analyses.

3.8 Dose Assessment

- 3.8.1 Project IDC: Perform individual dose assessment(s) for confirmed intakes of radioactive material in a timely manner.
- 3.8.2 Project IDC: If committed effective dose is <10 mrem, generate a letter to be included in the individual’s file that includes intake date(s), route of intake, bioassay results and dose. This information is maintained for later use should the individual receive additional intakes within the same calendar year resulting in a committed effective dose ≥ 10 mrem.
- 3.8.3 Project RadCon Manager or Designee: Sign the letter and forward to the ICP Internal Dosimetrist.
- 3.8.4 ICP Internal Dosimetrist: Review letter and have filed to the individual’s file as appropriate.
- 3.8.5 Project IDC: If committed effective dose is ≥ 10 mrem, complete Form 441.27, Internal Dosimetry Dose Assessment Report (IDDAR) in accordance with instructions provided. A committed effective dose ≥ 10 mrem is to be recorded in the employee’s occupational exposure record for the appropriate year of intake.
- 3.8.6 ICP Internal Dosimetrist: Perform an independent review and approve each dose assessment IDDAR prior to the dose being assigned to the employee’s does of history record.
- 3.8.7 ICP Internal Dosimetrist: Record in Sentinel database final internal dose of record for dose assessments when committed effective dose is ≥ 10 mrem.

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- 3.8.8 Radiation Dosimetry Technical Support Manager or Designee: Provide results of bioassay sampling, including dose assessment values, upon request from any employee who participates in a bioassay program.
- 3.8.9 Project RadCon Manager or Designee: Arrange a meeting with the employee, whenever possible, and discuss the results of internal dose assessment. Provide an opportunity for the employee to ask questions and have them answered; addressing any concerns the employee may have with the basis for the assigned dose. Ask that the employee sign the Internal Dosimetry Dose Assessment Report, after having had the opportunity to discuss it. Provide the employee with a copy of the Internal Dosimetry Dose Assessment Report.

3.9 Bioassay Tracking and Record Keeping

NOTE: *Bioassay requests initiated in Sentinel are tracked from the time of request through sample receipt, in vitro sample shipping, in vivo or in vitro bioassay analysis, and dose assessment. This assures compliance with regulations and an easily tracked resolution of any concerns. MCP-3934 Sentinel Bioassay Module User Guide, contains instructions for using the Sentinel bioassay management module for scheduling, requesting and tracking employees who are required to participate in a bioassay program.*

- 3.9.1 Project RadCon Manager or Designee: Organize local bioassay programs based on the facility Internal Dosimetry TBL and use the Sentinel program to schedule and request bioassays, as appropriate.
- 3.9.2 Radiation Dosimetry Technical Support Manager or Designee: Maintain a file of all hard copy reports of documented internal dose assessments. The assigned internal dose is recorded to the dose history database as committed effective dose and committed equivalent dose to an organ or tissue and for inclusion in total effective dose, total equivalent dose to an organ or tissue and life time dose totals for the corresponding employee.

4. RECORDS

Form 441.A10 New Hire Baseline Bioassay Screening Worksheet

Form 441.23, Bioassay Sample Record

Form 441.27, Internal Dosimetry Dose Assessment Report

Form 441.29, Job Specific Bioassay Evaluation

Dose of Record Assessments including supporting documents

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NOTE: *The Records Schedule Matrix, located on the intranet at http://edms.inel.gov/docs/matrix/mtx_menu.html, and the applicable facility, organization, program, or project records management plan and records type list provide current information on uniform file codes, disposition authorities, and retention periods for these records.*

5. DEFINITIONS

Assigned Protection Factor (APF): The expected workplace level of respiratory protection that would be provided by a properly functioning respirator or a class of respirators to properly fitted and trained users. (ANSI Z88.2-1992)

Bioassay: Measurement of amount or concentration of radioactive material in the body or in biological material excreted or removed from the body and analyzed for purposes of estimating the quantity of radioactive material in the body.

In Vitro Bioassay: Measurements to determine the presence of or to estimate the amount of radioactive material in the excreta or in other biological materials removed from the body. Examples include urine, fecal, blood, and mouth or nasal swabs.

In Vivo Bioassay: The measurements of radioactive material in the human body utilizing instrumentation that detects radiation emitted from the radioactive material in the body. Examples include whole body, lung, wound and thyroid counts.

Job Specific Bioassay: Bioassay monitoring for a radiological worker who will be engaged in an RWP specified task or job for which a bioassay is determined specifically for the task being performed. An initial (start of job) and end (completion of task) bioassay is the most positive method to assess the potential for intake of radionuclides.

New Hire Baseline Bioassay: Bioassay monitoring performed on newly hired employees (including subcontractor, force account and rehired individuals) who have worked at other nuclear installations and may have received an intake of a radioactive material that could impact evaluations by the ICP Internal Dosimetry Program.

Periodic Bioassay: Bioassay monitoring performed to demonstrate (confirm) the adequacy of radiological controls in limiting intakes of radionuclides or to aid in determining the ubiquitous levels of naturally occurring radionuclides. This type of monitoring is effective when applied to a stable workforce with well defined work activities and known hazards in which the bioassay results are expected to reflect effective radiological controls. The basis for employee selection and the bioassay frequency are described in each of the project specific technical basis documents.

Special Bioassay: Bioassay monitoring used to confirm or reject suspected intakes or depositions of radioactive materials, to more accurately identify and characterize the

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amount of radionuclides taken into the body, and to establish the individual pattern of excretion from the body for the purpose of dose assessment.

Termination Bioassay: Bioassay monitoring of an individual taken upon termination of their employment, to establish and document the employee's final radiological status.

Technical Basis Document. A general document supported by facility specific criteria and organized as Engineering Design Files that provide technical guidance, rationale, and organizational structure for the internal dosimetry program.

6. REFERENCES

DOE-STD-1121-98, Internal Dosimetry (Reaffirmation with Errata May 2003).

MCP-3934, *Sentinel Bioassay Module User Guide*,

TBL-130, *Idaho Cleanup Project Technical Basis Document for Internal Dosimetry*,
TBL-171, *RadCon Technical Basis for Establishing Levels of Radionuclide Intakes for Consideration of Medical Intervention*.

PRD-183, Radiological Control Manual.

Title 10 Code of Federal Regulations Part 835, June 8, 2007 and Current Implementation Guide for Use with 10 CFR 835.

Title 10 Code of Federal Regulations Part 20, January 1, 2006.

7. APPENDICES

Appendix A, Bioassay Program General Information Sheet

Appendix B, Procedure Basis

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Appendix A

Bioassay Program General Information Sheet

Why am I being asked to submit a bioassay sample?

You are being asked for a bioassay sample as part of the ICP Internal Dosimetry Program. In many cases, we are confirming the absence of internally deposited radioactive material, rather than expecting to see anything unusual. If there is reason to suspect that radioactive material may have been taken up internally, bioassay samples may be requested to evaluate and estimate the extent of the exposure.

Is this program worth all the inconvenience?

As mandated by federal law (Title 10 Code of Federal Regulations Part 835), internal dose evaluations shall be conducted for radiological workers who, under typical conditions, are likely to receive 100 mrem or more from a radioactive material intake. Bioassay samples, along with whole body counting, allow us to watch for the presence of internally deposited radioactive material and if necessary to estimate an internal dose. The internal dosimetry program is a supplement to the overall radiological control program (e.g., air monitoring, contamination control practices, radiological worker training, etc.) and plays an important role toward demonstrating that those who work with radioactive materials have done so safely and with minimum risk of receiving greater than 100 mrem Committed Effective Dose.

What happens to radioactive material once it gets inside my body?

The body handles radioactive material just as if it were any other material. Depending upon the chemical nature of the material, some of it may be retained by the body and the rest of it will be eliminated as liquid or solid waste.

Why can't I just get a whole body count?

Whole body counts are used to look for radioactive materials (inside the body) which emit high energy gamma rays. Gamma rays have the ability to pass through a person's body. Therefore, detectors positioned outside the body can detect the presence of these radionuclides. However, there are other radionuclides that emit primarily alpha or beta particles which may not be detected with a whole body count. If these radioactive materials are suspected, they are best detected in a urine or fecal bioassay sample.

How does radioactive material get inside my body?

There are four ways in which radioactive material may enter the body:

1. Inhaling radioactive material.
2. Ingesting radioactive material.

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3. Absorbing radioactive material through the skin.
4. Injecting radioactive material as a result of a puncture or wound.

What is a “24-hour” sample, and why is it necessary?

A “24-hour” sample is a sample which is representative of a full day's clearance of activity from the body. With a urine sample, this often requires the collection of more than one voiding during a 24 hour period. In the case of fecal samples, usually a single normal voiding is representative. The biological models used in calculating internal radiation doses are based on "fractional excretion rates". This means that the solid or liquid waste collected must represent the total elimination for an entire 24-hour period. There is no easy way to correct for samples which do not represent a full 24-hour's clearance.

How are bioassay samples used?

Bioassay samples are either evaporated or chemically reduced to an “ash” which can then be counted by a radiation detector. Samples may undergo some form of chemical separation.

What happens to the results of my bioassay?

The results of your bioassay are sent to the Internal Dosimetry Program staff. The results are reviewed and recorded to a bioassay analysis database. If radioactive material of occupational origin is detected, then *follow-up monitoring* may be requested as part of an investigation to identify when the intake most likely occurred, the types and quantities of radionuclides involved, and the estimation of an occupational dose.

If the measured radioactivity results in an estimated internal dose >10 mrem Committed Effective Dose, a summary letter will be sent from Radiation Dosimetry and Records (RDR) informing you of the results. The dose will then be recorded to your dose history and the Radiation Dosimetry and Records group will file the official dose assessment. If you do not receive a summary letter, then either the bioassay analysis did not detect any radionuclides of occupational concern or the dose assessment was less than 10 mrem Committed Effective Dose.

ICP Radiation Dosimetry and Records has been designated by the Department of Energy (DOE) to maintain the official exposure records for the Idaho National Laboratory (INL) site. Official copies of your records must be issued by RDR and may be requested at any time via form DOE F 1800, Privacy Act Information Request. If you desire to review your internal dose assessment or have any questions or concerns pertaining to the bioassay program, please contact the facility IDC at the facility where you work or one of the internal dosimetry staff members at Radiation Dosimetry and Records.

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Appendix B

Procedure Basis

Step	Basis	Source	Citation
2.1	Information on radiation exposure reported to employees treated as limited access	Privacy Act of 1974 10 CFR 835	§835.801(d)
2.2	Employee participation in a bioassay program	10 CFR 835.402(c) DOE G 441.1C PRD-183-5	§835.402(c) Article 521 and 522
3.1	Preparation of Technical Basis Documents	10 CFR 835.402(d)(1) DOE G 441.1C PRD-183-5	§835.402(d) Article 521 and 522
3.1.5	Rank source term table in terms of dose fraction	Corrective Action USDOE Audit	
3.2	Evaluation of Radiological Work for Internal Dosimetry	Corrective Action Commitment: EH-25 Audit Assessment of Internal Dosimetry Program, J. McDuffee, 3/10/99	
3.2.4 – 3.2.7	Institute web based new hire baseline bioassay screening process.	Corrective Action USDOE Audit	
3.3	Remove statement from TBL-130 and incorporate in procedure MCP-191	Corrective Action Commitment: EM-62 Audit	
3.4	Added guidelines for special bioassay evaluation	Bruce Wallen 09/31/06	
3.5	Added guidelines for termination bioassay determination	10 CFR 835 DOE G 441.1C	
3.6	Imposing employee work restrictions for failing to comply with bioassay program requirements.	10 CFR 835.402(c) DOE G 441.1C PRD-183-5	§835.402(c) Article 522
3.7.2	Medical Intervention	DOE-STD-1121-2008	Section 10
3.6 – 3.8	Interpreting and resolving Bioassay results.	DOE G 441.1C PRD-183-5	Article 523
3.9	Reporting of results to employee	10 CFR 835.801 DOE G 441.1C PRD-183-5	§835.801 Articles 521, 522 and 523