Personnel Monitoring for Exposure

Revision 4

Authored By:	Signature on File Michael A. Carr, CHP, Commercial Services Radiation Safety Officer	10/13/2015 Date
Reviewed By:	Signature on File David Ochs, Project Manager	10/13/2015 Date
Reviewed By:	Signature on File Pam Heckman, Corporate Dosimetry Program Manager	10/13/2015 Date
Approved By:	Signature on File Ben Sklar, Director of Projects	10/13/2015 Date

[X] Non-Proprietary	[ ] New
[ ] Proprietary	[ ] Title Change
[ ] Restricted Information	[X] Revision
[ ] Safeguards Information	[ ] Rewrite
[ ] Sensitive Security Information	[ ] Cancellation

Effective Date Oct. 14, 2015

Table of Contents

1.0 PURPOSE AND SCOPE

Proper personnel monitoring is necessary to ensure the accurate tracking and measurement of personnel dose and to help ensure that federally-imposed exposure limits as well as Energy*Solutions'* Corporate administrative limits are not exceeded. Additionally, the monitoring program must be adequately designed to accurately assess and determine a person's exposure in order to make the proper notifications and to properly assess and implement future controls to ensure personnel safety. This includes both monitoring for external exposure through the use of personnel monitoring devices as well as monitoring for internal exposure through a bioassay and air monitoring program as necessary.

1.1 Purpose

This procedure provides the guidance and the methodology to be implemented by the Commercial Services Radiation Protection Program to ensure proper personnel monitoring for radiation exposure and for establishing and maintaining accurate exposure records in accordance with Federal Regulations.

1.2 Scope

This procedure is for the exclusive use of the Energy*Solutions* Project Support Division and contractors at field project sites where Energy*Solutions* has the primary role in controlling exposures to on-site personnel. For projects in which Energy*Solutions* does not provide the primary role for personnel monitoring, the portions of this procedure which cover the request for personnel monitoring histories still apply for Energy*Solutions* personnel and those subcontractors that report directly to Energy*Solutions*. Requirements herein are applicable to no other operational entities of Energy*Solutions*.

2.0 REFERENCES

2.1 10 CFR 20, *Standards for Protection Against Radiation*

2.2 10 CFR 19.13, *Notifications and Reports to Individuals*

2.3 ES-AD-PR-005, *First Notification*

2.4 CS-RS-PG-001, *Commercial Services Radiation Protection Program*

2.5 CS-RS-PG-002, *Respiratory Protection Program for Radionuclides - Commercial Services Projects*

2.6 CS-RS-PR-015, *Air Sampling and Analysis*

2.7 CS-RS-PR-016, *Bioassay Sampling*

2.8 CS-RS-PR-017, *External Dose Assessments*

2.9 CS-RS-PR-018, *Internal Dose Assessments*

2.10 CS-RS-PR-019, *DAC-Hr Tracking*

2.11 US NRC, Regulatory Guide 8.7, *Instruction for Recording and Reporting Occupational Radiation Exposure Data*

2.12 US NRC, Regulatory Guide 8.34, *Monitoring Criteria and Methods to Calculate Occupational Radiation Doses*

2.13 US NRC, Regulatory Guide 8.36, *Radiation Dose to the Embryo/Fetus*

3.0 GENERAL

3.1 Definitions

3.1.1. *Absorbed dose* – The energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the rad and the gray (Gy).

3.1.2. *Administrative Limit* - A radiation dose limit established by Energy*Solutions* for the purpose of maintaining radiation dose below regulatory limits. If this limit is exceeded, it does not constitute a regulatory violation or non-compliance unless a regulatory limit is exceeded. Specific approvals are required to exceed any administrative limit.

3.1.3. *Airborne Radioactive Material or Airborne Radioactivity* - Any radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors, or gases.

3.1.4. *ALARA (As Low As Reasonably Achievable)* - The basic philosophy of radiation protection is to maintain radiation exposures ALARA below the regulatory requirements. "Reasonable" means the costs, benefits, and risks are considered in trying to keep doses low.

3.1.5. *Annual Limit on Intake (ALI)* - The derived regulatory limit for the amount of radioactive material that can be taken into the body of an adult worker by inhalation or ingestion in a year.

3.1.6. *Backup Dosimeter* - A device used to assess an individual's unofficial dose that is capable of being read directly by the individual in the field (i.e., self-reading pocket dosimeter (SRPD), electronic digital display dosimeter (ED), or equivalent).

3.1.7. *Bioassay* - Determination of the kind, quantity or concentration, and the location of radioactive material in the human body by direct measurement (in-vivo) or by analysis of materials excreted or removed from the human body (in-vitro).

3.1.8. *Committed Dose Equivalent (CDE) (HT_{50})* - The dose equivalent to organs or tissues of reference (T) that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

3.1.9. *Committed Effective Dose Equivalent (CEDE)* - The sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues. $H_{E,50} = \Sigma W_T * H_{T,50}$

3.1.10. *Control TLD* - A reference TLD used to monitor non-occupational TLD exposure used to correct the reported exposure results to personnel

3.1.11. *Declared Pregnant Woman (DPW)* - A woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception.

3.1.12. *Deep Dose Equivalent or DDE (H_d)* – The external whole body exposure or dose equivalent at a tissue depth of 1 cm (1000 mg/cm^2).

3.1.13. *Derived Air Concentration (DAC)* - The concentration of a given radionuclide in air that, if breathed by the reference man for a working year of 2,000 hours at 1.2 m^3 /hour (light work), results in an intake of approximately one ALI.

3.1.14. *Derived Air Concentration-Hour (DAC-Hr)* - The product of the concentration of radioactive material in air (expressed as a fraction or multiple of the derived air concentration for each radionuclide) and the time of exposure to that radionuclide, in hours.

3.1.15. *Dose* - A generic term meaning absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent, as defined elsewhere in this section.

3.1.16. *Dose Equivalent (H_T)* – The product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and sievert (Sv).

3.1.17. *Dosimeter of Legal Record (DLR)* – Any passive dosimeter for which NVLAP accreditation has been obtained and which may be used as a dosimeter of legal record such as a TLD or OSL.

3.1.18. *Effective Dose Equivalent or EDE (H_E)* – The sum of the products of the dose equivalent to the organ or tissue (H_T) and the weighting factors (W_T) applicable to each of the body organs or tissues that are irradiated ($H_E = \Sigma\ W_T * H_T$).

3.1.19. *Estimated Dose* - Dose that is normally based on results obtained from backup dosimeters, survey information, or incomplete bioassay information.

3.1.20. *Exposure* - Means being exposed to ionizing radiation or to radioactive material.

3.1.21. *External dose* – The portion of the dose equivalent received from radiation sources outside the body.

3.1.22. *Extremity* – A person's hand, elbow, arm below the elbow, foot, knee, or leg below the knee.

3.1.23. *Eye (Lens) Dose Equivalent (LDE)* - External exposure to the lens of the eye taken as the dose equivalent at a tissue depth of 0.3 cm (300 mg/cm^2).

3.1.24. *Gray (Gy)* – The SI unit of absorbed dose. One gray is equal to an absorbed dose of 100 Joules per Kilogram (100 rad).

3.1.25. *Health Physics Database* – A database used for tracking personnel occupational radiation exposure, training, bioassays and other related health physics data.

3.1.26. *Individual Monitoring* - The assessment of dose equivalent or committed effective dose equivalent to an individual through the use of commonly employed monitoring methods (e.g., TLD, bioassay, and survey data).

3.1.27. *Individual monitoring device* - A device worn by an individual for the assessment of dose equivalent, such as film badge, thermo luminescence dosimeter (TLD), optically stimulated luminescence dosimeter (OSL), electronic dosimeter (ED) or a self or direct reading dosimeter (SRD / DRD).

3.1.28. *Internal Dose* - That portion of the dose equivalent received from radioactive material taken into the body.

3.1.29. *In-Vitro Bioassay (in-direct)* - The estimation of radioactivity in the human body based (1) on the measurement of radioactivity in excreta or other materials taken from the body and (2) on a biological model for the radionuclide movement in body tissues and organs.

3.1.30. *In-Vivo Bioassay (direct)* - The measurement of radioactivity in the human body using instrumentation that detects radiation emitted from radionuclides in the body.

3.1.31. *Lens dose equivalent (LDE)* - The external exposure to the lens of the eye taken as the dose equivalent at a tissue depth of 0.3 centimeter (300 mg/cm^2).

3.1.32. *Member of the Public* - Any individual except when that individual is receiving an occupational dose.

3.1.33. *Monitoring* - The measurement of radiation levels, concentrations, surface area concentrations or quantities of radioactive materials and the use of these results and measurements to evaluate potential exposures and doses.

3.1.34. *NRC Form 4* - The form used to document previous occupational radiation exposure. Information on NRC Form 4 is supported by documentation from other facilities at which the individual was previously monitored and/or a signed written statement from the individual.

3.1.35. *NRC Form 5* - The form used to record current occupational radiation exposure. Information on NRC Form 5 is obtained from official records of primary dosimeter results or is based on backup dosimeter information and industry accepted calculating techniques.

3.1.36. *Occupational Dose* - The radiation dose any individual receives in a restricted area and any other work-related radiation dose the person receives. Does not include medical dose, dose due to background radiation, or dose received while a member of the public.

3.1.37. *Occupational Dose Limit* - The maximum legally allowable dose to individuals during a specific time period, as defined by the applicable regulations.

3.1.38. *Official Dose (Record Dose)* - The dose determined and recorded for an individual that is posted to an individual's radiation dose history. The official dose is normally based on the results of primary dosimeter processing but could be based upon calculations from bioassay results or air sample analysis and exposure period, from survey data and/or other recognized techniques.

3.1.39. *Optically Stimulated Luminescent (OSL) Dosimeter* - An integrating detector where radiation energy is absorbed (trapped) and can be read out later by optical stimulation.

3.1.40. *Personally Identifiable Information (PII)* – Personal information including social security numbers, dates of birth, home address, mother's maiden name, financial data, etc. that if not properly controlled can either lead to identity theft or compromise the individual's security.

3.1.41. *Primary Dosimeter* - A DLR device used to monitor and assess a single individual's dose of record (e.g., TLD or OSL).

3.1.42. *Prospective Evaluation* - An evaluation to determine if external or internal monitoring is required by regulations for an individual prior to exposure to radiation. The evaluation will include factors such as: dose rates, work task duration, prior doses on similar tasks, and exposure conditions to determine if monitoring is required.

3.1.43. *Public Dose* - Dose received by a member of the public from exposure to radiation and radioactive material released by a licensee, or to another source of radiation either within a licensee's or registrant's controlled areas or in unrestricted areas. Public dose does not include occupational dose or doses received from background radiation, as a patient from medical practices, or voluntary participation in medical research programs.

3.1.44. *Quality Factor (Q)* - The modifying factor used to derive dose equivalent from absorbed dose. Quality factors are listed in the tables as provided in 10CFR20.1004.

3.1.45. *Radiological Controlled Area (RCA)* - Any area to which access is controlled and that is posted because of the presence of radiation or radioactive materials. Radiological Controlled Areas include Radioactive Materials Areas, Contamination Areas, Radiation Areas, High Radiation Areas, Very High Radiation Areas, and Airborne Radioactivity Areas.

3.1.46. *Rad* - The special unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/gram or 0.01 joule/kilogram (0.01 gray).

3.1.47. *Rem* - The special unit of any of the quantities expressed as dose equivalent. The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor, Q (1 rem = 0.01 sievert).

3.1.48. *Restricted Area* - An area having access control with the intent of preventing or controlling the radiation exposure of individuals.

3.1.49. *Self Reading Dosimeter (SRD)* - A monitoring device consisting of a collection chamber coupled with an optical lens and calibrated scale. SRDs are normally used as a backup dosimetry device to provide individuals with an immediate estimate of their external gamma and x-ray radiation exposure. The SRD is sometimes referred to as a Direct Reading Dosimeter (DRD).

3.1.50. *Shallow dose equivalent (Hs)* - The external exposure to the skin of the whole body or an extremity taken as the dose equivalent at a tissue depth of 0.007 centimeter (7 mg/cm^2).

3.1.51. *Sievert (Sv)* – The SI unit of any of the quantities expressed as dose equivalent. The dose equivalent in sieverts is equal to the absorbed dose in grays multiplied by the quality factor, Q (1 Sv = 100 rem)

3.1.52. *Thermo-luminescent Dosimeter (TLD)* - An integrating detector where radiation energy is absorbed (trapped) and can be read out later by thermal excitation of the detector.

3.1.53. *Total Effective Dose Equivalent (TEDE)* - The sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures). TEDE = EDE + CEDE

3.1.54. *Total Organ Dose Equivalent (TODE)* - The sum of the deep dose equivalent and the committed dose equivalent to the organ receiving the highest dose. TODE = DDE + CDE

3.1.55. *Visitor* - An escorted individual who enters a Restricted Area.

3.1.56. *Whole body* – A person's head, trunk (including male gonads), arms above the elbow, or legs above the knee for the purpose of external exposure.

3.2 Responsibilities

Note: Depending upon personnel qualifications and the size of the project, project personnel may be assigned multiple roles and/or responsibilities.

3.2.1. Commercial Services Radiation Safety Officer

The Commercial Services Radiation Safety Officer (CS RSO) maintains and oversees the implementation of the CS Radiation Protection and Respiratory Protection Programs. The CS RSO shall ensure that radiation safety, radioactive materials management, and radiological operations procedures and programs are kept up to date such that they comply with current regulations and incorporate current and relevant industry practices and regulatory guidance. The CS RSO shall assist the Project Health Physicist (PHP) in providing guidance for field projects on the proper personnel monitoring requirements and techniques, bioassay sampling frequencies, use of dosimetry and the specification of laboratory detection levels.

3.2.2. Corporate Dosimetry Program Manager

The Corporate Dosimetry Program Manager (CDPM) is responsible for the implementation, management and data verification of the company designated Health Physics Database and the occupational radiation exposure tracking for Energy*Solutions* personnel while not assigned work at any fixed facilities. The CDPM shall assist Project Managers and Dosimetry Specialists with the compliance of any governing regulatory requirements and corporate procedures as applicable.

3.2.3. Project Manager

The Project Manager (PM) is responsible for ensuring that the proper procedures and programs are implemented on the project site as required by customer agreements and contracts. The PM is responsible for ensuring that these programs and procedures are properly incorporated into project specific plans and procedures. The PM is responsible for ensuring that Commercial Services and/or client programs and procedures are available for use by field personnel. The PM shall also ensure that individuals provide bioassays and exchange dosimetry as required.

3.2.4. Project Health Physicist

The Project Health Physicist (PHP) is responsible for assisting the CS RSO in providing health physics support to the PM and Radiation Protection Supervisor (RPS). This includes technical support to ensure procedural and regulatory compliance and to ensure that the project specific Data Quality Objectives are met. The PHP is responsible for specifying that primary monitoring devices are provided by a NVLAP accredited vendor, determining proper personnel monitoring and

bioassay requirements, bioassay sampling and dosimeter exchange frequencies, reviewing vendor DLR (dosimeter of legal record; i.e., TLD or OSL) and bioassay reports, and evaluating the need for using multiple whole body, neutron and extremity dosimeters and evaluating the need for additional (special) bioassays and dosimetry.

3.2.5. Radiation Protection Supervisor

The Radiation Protection Supervisor (RPS) is responsible for implementing the CS Radiation Protection and Respiratory Protection Programs and the project specific radiological requirements at the field project location. The RPS manages and oversees the project personnel in regards to radiation and respiratory protection and reports directly to both the PM and the CS RSO. The RPS, shall in conjunction with the PM and the PHP, ensure that all personnel have followed the requirements for both internal and external monitoring including the issue and collection of bioassay kits and personnel monitoring devices.

At project sites where Energy*Solutions* issues and manages dosimetry, the RPS is responsible for:

- Issuing and collecting dosimetry;
- Issuing and collecting bioassay kits;
- Ensuring the receipt of bioassay samples and results;
- Maintaining project exposure logs;
- Maintaining control of dosimetry and bioassay samples; and
- Maintaining dose records on-site for the duration of the project.

3.2.6. Project Personnel

All project personnel are responsible for wearing the required personnel monitoring devices as specified by the Radiation Work Permit (RWP) and providing bioassay samples as directed by the RPS following the sampling protocols as specified.

3.3 Precautions and Limitations

3.3.1. NRC regulations in 10 CFR 20 require that primary dosimeter vendors hold current personnel dosimetry accreditation from the National Voluntary Laboratory Accreditation Program (NVLAP). Ensure that vendors are NVLAP accredited for the type of dosimeters to be used.

3.3.2. Dosimeters need to be adequately protected from physical abuse and harsh environments.

3.3.3. The primary dosimeter holders themselves shall not be tampered with or opened except by authorized personnel.

3.3.4. Dosimetry should not be x-rayed or exposed to excessive heat and water.

3.3.5. The assigned Deep Dose Equivalent (DDE) shall be for the part of the body receiving the highest exposure.

3.3.6. The assigned Shallow Dose Equivalent (SDE) shall be dose averaged over the contiguous 10 cm^2 of skin receiving the highest exposure.

3.3.7. In general for ease of reporting personnel exposure, the maximum whole body TLD should be used and reported as DDE. In cases where multiple dosimeters are used, calculate whole body exposure based on weighting factors. Use the DDE line on the NRC Form 5 to document the whole body exposure for the individual and file the summary on the use of multiple dosimeters and weighting factors in the respective personnel file(s).

3.3.8. Documents containing PII shall be controlled. Hard copy records will be locked and electronic records password protected to limit access to authorized personnel only.

3.4 Records

3.4.1. Prospective Evaluation

3.4.2. Occupational Exposure History Request

3.4.3. Dosimetry Issue / Request Form

3.4.4. Pregnancy Declaration

3.4.5. Visitor Access Log

3.4.6. NRC Form 5

3.4.7. Personnel Exposure Logs

3.4.8. Public Dose Evaluation

4.0 REQUIREMENTS AND GUIDANCE

4.1 Exposure Limits

4.1.1. The limits for personnel exposure are provided as Attachment 5.1 as imposed by federal regulations including the administrative limits as implemented by Energy*Solutions* (Corporate) and Commercial Services to ensure personnel exposures are maintained ALARA.

4.1.2. It is Energy*Solutions* policy that minors below the age of 18 shall not receive any occupational exposure.

4.1.3. The federally-imposed annual exposure limit for the general public and non-occupationally exposed workers is 100 mrem. This includes the general public outside the site boundary, general public allowed access to the site (visitors) and non-occupationally exposed workers.

4.2 Monitoring Requirements

4.2.1. Methods of personnel monitoring may include both external and internal monitoring, or a combination thereof, depending upon the potential routes of personnel exposure.

4.2.2. The PHP and/or CS RSO should perform a prospective evaluation in accordance with Section 4.3 to assess the exposure pathways and to determine if personnel monitoring is required. If a prospective evaluation is not performed, all personnel entering a controlled area shall be monitored.

4.2.3. All personnel shall be monitored as specified by the PHP and/or CS RSO and as required by the Project Work Plans and procedures.

4.2.4. Personnel exposure shall be monitored for any project employee anticipated to receive a sum of both **external** dose and **internal** dose from the intake of radionuclides in excess of 10% of the regulatory exposure limits from licensed sources of radiation. The annual occupational exposure limits requiring monitoring include:

- 500 mrem TEDE,
- 1,500 mrem total LDE to the lens of the eye,
- 5,000 mrem total EDE / DDE and CDE to any specific organ or tissue other than the eye, or
- 5,000 mrem shallow dose equivalent to the skin of the whole body or to the skin of the extremities.

4.2.5. Projects using the Commercial Services RPP shall require personnel monitoring if any individual is anticipated to receive an EDE or DDE in excess of 50 mrem over the project duration; however, monitoring should be considered if the individual is anticipated to exceed an EDE or DDE of 10 mrem in one month.

4.2.6. All personnel entering a high radiation or very high radiation area shall be monitored for external occupational dose even if an evaluation shows the dose is not expected to exceed 10% of the applicable exposure limits.

4.2.7. Personnel who may be exposed in excess of 200 DAC-hrs or 10% of the Annual Limit on Intake (ALI) over the project duration or greater than 10 DAC-hrs in any one week shall be routinely monitored for internal exposure.

4.2.8. All personnel who wear respiratory protection for the protection against airborne radionuclides in accordance with Reference 2.5, CS-RS-PG-002, *Respiratory Protection Program for Radionuclides - Commercial Services Projects*, shall be routinely monitored for internal exposure either by bioassay sampling (in-vivo or in-vitro) or DAC-hr tracking.

4.2.9. Any additional dose to individuals whose exposure is within 80% of the Energy*Solutions* administrative limits as specified in Attachment 5.1 should be controlled more closely, with additional monitoring as required to ensure the administrative limits are not exceeded.

4.3 Prospective Evaluation

4.3.1. The PHP and/or CS RSO should assess the potential exposure pathways for project personnel to determine the routes of exposure in order to determine the proper personnel monitoring requirements.

4.3.2. Determine if there is an external and/or internal exposure concern and whether personnel exposure may exceed 10% of the regulatory exposure limits as specified in section 4.2.4 requiring personnel monitoring. The assessment should include the following as applicable:

- Identify the radionuclides of concern,
- Review of existing dose rate and loose surface contamination surveys,
- Review of existing air sampling results,
- Review of the work tasks to be performed,
- Estimated project or task duration,
- Prior monitoring results for similar work,
- Dose modeling, and
- Professional judgment.

4.3.3. The prospective evaluation should be documented and maintained with the project files.

4.3.4. If personnel monitoring is not required as determined by the prospective evaluation, justification shall be documented; however, consideration should be made for some limited monitoring as confirmation, such as area TLDs and/or random bioassays or air monitoring.

4.3.5. If personnel monitoring is not required and a subsequent evaluation shows that the individual exceeded (or will exceed) the monitoring limit threshold, then an estimate of the unmonitored exposure shall be documented and reported for the time period the individual was not monitored. This dose shall be added to any monitored dose.

4.4 Exposure History / Requests

4.4.1. For projects in which Energy*Solutions* does not have the primary role for personnel monitoring, (i.e., personnel monitoring is being performed by the client or other program), all project personnel shall complete and sign the exposure request form, Attachment 5.1 and provide the form to the PM. The PM shall submit the completed forms to the applicable program responsible for personnel monitoring authorizing the release of the records to the CS RSO or designee.

4.4.2. Prior to issuing dosimetry, an attempt shall be made by the CS RSO, or designee, to compile the current year exposure for personnel from all locations where they have been monitored for the current calendar year.

4.4.3. Each individual issued dosimetry shall provide a list of all locations where they have been monitored and any exposure records as available.

4.4.4. If the individual does not have the exposure records, the individual shall complete the exposure request form, Attachment 5.1, and sign the form authorizing the release of the records to the CS RSO or designee.

4.4.5. Estimated doses may be accepted when official doses are not yet available; however, the official dose should be obtained and updated as soon as available.

4.4.6. If no response is received within 45 days of an exposure history request, the records shall be considered unobtainable and the request form noted as such.

4.4.7. Maintain documentation of all attempts to obtain dose history records, including the name, address, date, and response of the individual or organization contacted. Documentation may include written, signed, dated statements by the licensee or the individual that the exposure records are unobtainable, including an explanation as to why.

4.4.8. Dose of record should be provided on an NRC Form 5 or equivalent; however, a written signed statement from the individual or from the individual's most recent employer of work involving radiation exposure is acceptable.

4.4.9. A statement is required even if the individual received no exposure or was not monitored for radiation exposure (normally on Attachment 5.3).

- If the record of dose cannot be obtained and the person's exposure cannot be estimated, then their annual exposure limit shall be limited to 100 mrem TEDE.

4.5 Dosimetry Issue

Note: All individuals entering an RCA shall be issued primary dosimetry unless a prospective evaluation has been documented indicating that monitoring is not required in accordance with Sections 4.2 and 4.3.

4.5.1. Primary dosimetry, such as a thermo-luminescent dosimeter (TLD) or an optically-stimulated luminescent (OSL) dosimeter, shall be provided to determine the dose of record.

4.5.2. The RPS and/or PHP shall determine the number and type of dosimetry required and contact the CS RSO or designee to order the dosimetry. The RPS and/or PHP should provide the following information as available for each individual:

- Name
- SSN
- Birth Date
- Mailing Address

4.5.3. Depending upon the anticipated dose, determine the change-out frequencies and monitoring periods. Typical monitoring periods include:

- Weekly
- Bi-weekly (every two weeks)
- Monthly
- Bi-monthly (every two months), and
- Quarterly

4.5.4. The PM and/or RPS shall ensure that each individual has successfully completed all required training (Radiation Worker Training, etc.) and completed a Dosimetry Issue Form, Attachment 5.3 or equivalent, prior to dosimetry issue.

4.5.5. The RPS shall review the Dosimetry Issue Form for completeness, accuracy, and legibility.

4.5.6. Primary dosimeters shall be:

- Capable of measuring the DDE at a tissue depth of 1.0 cm.
- Capable of measuring the LDE at a tissue depth of 0.3 cm.
- Capable of measuring the SDE at a tissue depth of 0.007 cm.

4.5.7. The RPS shall keep a dosimetry issue log listing all personnel to whom dosimetry has been issued.

4.5.8. Each primary dosimeter should be labeled with the individual's name and/or other identifying number (e.g., dosimeter number, security badge number, ID number, etc.).

4.5.9. All assigned dosimetry shall be retained at an appropriate access control point or centralized storage area when not worn and shall not to be removed from site.

4.5.10. A control dosimeter should be posted at the centralized storage area for personnel dosimeters.

4.5.11. All issued dosimetry shall be worn at all times while the individual is within the RCA.

4.5.12. Primary dosimeters shall be changed out in accordance with Section 4.9 as appropriate.

4.5.13. Primary dosimeters shall be processed by a laboratory or vendor maintaining accreditation by the National Voluntary Laboratory Accreditation Program (NVLAP) as follows:

- After routine exchange,
- When individual monitoring is no longer required,
- Upon employment termination,
- When backup dosimetry readings are unavailable, unreliable, or suspect, and subsequent investigations indicate that significant exposure may have been received,

- When an over exposure of an individual has occurred or is suspected,
- When special, non-routine circumstances (e.g., declared pregnant woman) cause the need for knowledge of an individual's current official dose, or
- As directed by the PM, RPS or PHP.

4.6 Backup Dosimeters

4.6.1. Backup dosimetry, e.g., self-reading dosimeters (SRDs) or electronic dosimeters (EDs), will be required for all individuals issued dosimetry for the following reasons:

- Declared Pregnant Worker;
- Personnel whose dose is anticipated to approach an Administrative Limit;
- Personnel exposures are expected to exceed 10 mrem/day;
- Dose rate fields are not well characterized;
- Dose rates could change significantly as a result of any work performed in the RCA; or
- Entries into High Radiation Areas and Very High Radiation Areas.

4.6.2. SRDs should read less than ¼ of full scale upon issuance and should be re-zeroed before reaching ¾ scale.

4.6.3. The RPS shall determine any alarm set points for EDs and instruct personnel to the proper response when an alarm goes off.

4.6.4. The wearer shall periodically read backup dosimetry during work to monitor their personal dose.

4.6.5. All backup dosimeter readings shall be recorded on the RWP access log or dose tracking system when entering and exiting the RCA.

4.6.6. The RPS should track the backup dosimetry results accordingly to monitor personnel exposure until the primary dosimeter is processed and the dose of record recorded.

4.6.7. For EDs, the ED dose should be tracked against the dose of record from the primary dosimetry.

4.6.8. If a backup dosimeter is discovered to be off-scale, the wearer shall:

- Notify others in the work area so they may check their backup dosimetry;
- Exit the work area immediately;
- Report the off-scale dosimeter to the RPS and PM; and
- Obtain approval from the RPS before re-entering an RCA.

4.6.9. In the event of an off-scale backup dosimeter, the RPS shall notify the PM and CS RSO, initiate an exposure investigation and an external dose assessment in accordance with Reference 2.8, CS-RS-PR-017, *External Dose Assessments* and submit a First Notification form in accordance with ES-AD-PR-005, *First Notification*, and as appropriate.

4.7 Multiple and Extremity Dosimetry

4.7.1. The RPS and PHP shall determine the need for multiple and extremity dosimetry.

4.7.2. Multiple dosimeters shall be worn for non-uniform dose fields in which the dose to portions of the whole body may vary by more than 30% and the anticipated total personnel exposure may exceed 100 mrem EDE or DDE.

4.7.3. Consideration shall be given to the sources of radiation, anticipated dose fields and the workers orientation when determining the placement of multiple dosimeters. Typical locations for multiple dosimeters include:

- Head
- Upper and lower back
- Chest
- Elbows/upper arms
- Gonads, and
- Knees/thighs

4.7.4. Extremity dosimetry shall be worn when handling high radiation sources and when the dose to the extremities is anticipated to exceed 10% of the extremity dose limits as provided in Section 4.1.

4.8 Wearing Dosimetry

4.8.1. Dosimetry shall be worn as directed by the RPS and/or PHP in accordance with the Radiation Work Permit (RWP).

4.8.2. Dosimeters shall be placed as follows:

- When exposure conditions will lead to relatively uniform whole body dose (DDE), the dosimeter shall be worn on the front of the body between the neck and waist.
- When exposure conditions will lead to a non-uniform dose to the whole body, the dosimeter shall either be moved to the body location of highest expected dose or multiple dosimeters shall be worn at locations which will include the point of the highest expected dose to the whole body.
- When the principal source of radiation is near the foot, place the whole body dosimeters just above the knee.

4.8.3. When both primary and backup dosimetry is issued, the backup dosimeter should be placed in close proximity to the individual's primary dosimeter to facilitate comparisons of results.

4.9 Dosimetry Exchange

4.9.1. Upon receipt of the dosimeters, the RPS shall perform an inspection to ensure each dosimeter shows no external damage, such as missing filters or windows. If a dosimeter is damaged, assign another dosimeter,

remove the damaged dosimeter from service and notify the PHP and/or CS RSO.

4.9.2. The RPS shall exchange dosimetry on the first day of the new monitoring period ensuring the names and/or dosimeter numbers match each dosimeter exchanged and document required information on the form.

4.9.3. The RPS shall forward a copy of the issue form to the Corporate Dosimetry Program Manager.

4.9.4. The RPS shall return the removed or exchanged dosimeters including the control, spare and emergency dosimeters to the supplier for reading in an expeditious manner in the return envelopes as provided.

4.9.5. The RPS shall ensure that shipments are not made on Fridays or on a day that would result in shipment over weekend days, to eliminate the potential of coming within close proximity to medical pharmaceutical shipments. This could result in unusually high readings.

4.9.6. It is recommended that all shipments of dosimetry consider adding an electronic dosimeter. This will aid in alerting the vendor upon receipt of the shipment to any high readings that may have occurred while in transit.

4.9.7. The RPS should make every attempt to arrange the package in such a way that at least 1-3 inches of space is between the dosimeters and the container. This space can be filled with any type of packaging material available that will not cause damage to the dosimeters.

4.9.8. All dosimetry shipped from processing shall be marked on the outside of the package:

CAUTION: Contents sensitive to radiation. Do not X-Ray. Keep away from radioactive materials, fluoroscope, open flame, excessive heat and water.

4.10 Lost or Damaged Dosimeter(s)

4.10.1. If a primary dosimeter is lost or damaged within an RCA, the wearer shall:

- Notify others in the work area;
- Exit the work area immediately;
- Report the lost or damaged dosimeter to the RPS or PM; and
- Obtain approval from the RPS before re-entering the RCA.

4.10.2. In the event of lost or damaged primary dosimeter, the RPS shall notify the PM and CS RSO, initiate an exposure investigation and an external dose assessment in accordance with Reference 2.8, CS-RS-PR-017, *External Dose Assessments* and submit a First Notification form in accordance with ES-AD-PR-005, *First Notification* as appropriate.

4.11 Internal Exposure Monitoring

Monitoring for internal exposure typically includes air monitoring, bioassay sampling or a combination thereof.

4.11.1. Internal dose monitoring shall be performed if:

- There is a potential for the occupational intake of radionuclides to exceed 10% of the ALI or 200 DAC-hrs over the project duration,
- There is a potential for an individual to receive in excess of 10 DAC-hrs of exposure in any one week.
- The CS Respiratory Protection Program is implemented, or
- As required by PHP and/or site-specific requirements.

4.11.2. Establish an appropriate air monitoring program in accordance with Reference 2.6, CS-RS-PR-015, *Air Sampling and Analysis*.

4.11.3. Internal dose monitoring may be performed either through bioassay monitoring in accordance with Reference 2.7, CS-RS-PR-016, *Bioassay Sampling*, or via DAC-hr tracking in accordance with Reference 2.10, CS-RS-PR-019, *DAC-Hr Tracking*.

4.11.4. If bioassay monitoring is required as prescribed by the PHP and/or CS RSO and independently reviewed by a qualified individual, the bioassay monitoring program may include the following:

- Confirmatory monitoring
- Routine monitoring, and
- Special monitoring

4.11.5. Confirmatory monitoring may be performed to verify exposure conditions for workers thought not likely to be exposed at levels requiring routine monitoring. This may be performed by randomly selecting personnel and submitting them to bioassay monitoring to verify the absence of any intake.

4.11.6. Routine monitoring should be performed when there is a potential for intake and involves the regular measurements of individual workers. It usually includes baseline measurements to document any pre-existing intake, periodic measurements to assess any potential intake, and a final bioassay when terminating employment or when terminating work with a specific radionuclide.

4.11.7. Special monitoring shall be performed as required for the confirmation of a suspected intake or for the follow-up evaluation of a confirmed intake. Instances that require special bioassay monitoring include:

- High facial or nasal contamination;
- Entry to airborne radioactivity areas without appropriate exposure controls;
- Spills or potential airborne radioactivity excursions due to process equipment failure;

- Whenever an intake ≥10 DAC hours may have occurred during the work week, based on air sampling data;
- Known or suspected incidents of worker ingestion of radioactive material;
- Actual or potentially contaminated wounds or skin absorptions; or
- Evidence of failure of respiratory protection equipment.

4.11.8. All internal monitoring protocols shall be approved by a qualified individual to ensure adequate detection sensitivities and monitoring frequencies.

4.11.9. Bioassay sampling protocols shall be based on the contaminants of concern, detection sensitivities and laboratory needs.

4.11.10. All positive bioassay results shall be reviewed by a qualified individual and an internal dose assessment performed in accordance with Reference 2.9, CS-RS-PR-018, *Internal Dose Assessments*.

4.12 Visitor Monitoring

4.12.1. Visitors are considered members of the public for the purposes of dose monitoring requirements and shall not exceed an individual annual cumulative dose in excess of 100 mrem.

4.12.2. Visitors shall not be granted unescorted access to an RCA; however, they may be granted escorted access with approval from the CS RSO or PHP.

4.12.3. Prior to issuing dosimetry to a visitor, the PM or designee shall ensure each visitor has received, or does receive, site specific and general awareness training.

4.12.4. Visitors shall be issued a backup dosimeter (SRD or ED) or an assigned primary dosimeter by the RPS and a record maintained of the visitor's dose record.

4.12.5. Each visitor shall sign a visitor access log and provide the following information:

- Name
- Last 4 digits of their SSN
- Birth Date, and
- Date and time of entry and exit

4.12.6. The RPS shall instruct visitors on how to use the dosimeter and the location where it is to be worn.

4.12.7. For groups of visitors, it is not required to issue a backup dosimeter to each member of the group provided that all members remain in the same vicinity; however, no more than five visitors shall be assigned to a single dosimeter.

4.12.8. If a visitor later becomes an employee, any significant dose (i.e., >10 mrem) received as a visitor shall be added to the individual's annual dose record.

4.12.9. Visitor personnel shall read their backup dosimeters and enter the information on the appropriate visitor access log.

4.12.10. If a visitor's backup dosimeter is off-scale or lost, notify the PM and CS RSO, initiate an exposure investigation and an external dose assessment in accordance with Reference 2.8, CS-RS-PR-017, *External Dose Assessments* and submit a First Notification form in accordance with ES-AD-PR-005, *First Notification* as appropriate. Provided the individual did not leave the group, use the SRD or ED reading for the escort or from SRDs/EDs worn by the other visitors in the group; otherwise an exposure investigation and external dose assessment shall be performed in accordance with Reference 2.8, CS-RS-PR-017, *External Dose Assessments* as appropriate.

4.12.11. If the total cumulative or single exposure for any visitor is 25 mrem or greater, personnel shall notify the RPS.

4.12.12. If the total cumulative or single exposure for any visitor is 50 mrem or greater, personnel shall notify the CS RSO who shall initiate a First Notification in accordance with Reference 2.3, ES-AD-PR-005, *First Notification*.

4.13 Public Monitoring

4.13.1. Site controls shall be implemented and site monitoring performed to demonstrate that a member of the public has not been exposed in excess of the public limit as specified in Section 4.1, (i.e., 100 mrem/year).

4.13.2. In the interest of ALARA, air emissions to the public shall be maintained such that an individual member of the public likely to receive the highest dose will not exceed a TEDE of 10 mrem for the year.

4.13.3. Public monitoring may be performed using any of the following or combination thereof to demonstrate compliance:

- Site boundary and/or perimeter TLDs,
- Site effluent monitoring,
- Site perimeter surveys,
- Area surveys and air samples,
- Occupational worker exposure reports, and/or
- Dose modeling.

4.13.4. A public dose assessment should be performed either at the end of the year or at the end of the project, whichever is sooner, and documented. All public dose assessments shall be reviewed and approved by the PHP and CS RSO.

4.14 Declared Pregnant Worker (DPW)

4.14.1. Declaration of pregnancy is entirely at the discretion of the woman (medical proof is not required). To declare pregnancy, the woman should inform the PM, RPS, or CS RSO by use of a Declaration of Pregnancy Form (Attachment 5.4 or equivalent). An estimated date of conception should be provided.

4.14.2. A DPW may declare and undeclared at any time without providing any reason.

4.14.3. Upon declaration, the PHP and/or CS RSO shall perform a dose assessment in accordance with Section 4.16 in order to assess any prior dose to the embryo/fetus between the dates of conception and declaration.

4.14.4. The PHP and/or CS RSO shall assess any assigned dose to the DPW and restrict any work as necessary to ensure the limits for the DPW and the embryo/fetus, as provided in Section 4.1, are not exceeded.

4.14.5. If it has been determined that the DPW and embryo/fetus have exceeded the limits at the time of declaration, all work with radioactive materials and any further occupational exposure are not authorized.

4.14.6. A DPW shall not be allowed to enter high radiation areas, very high radiation areas or be assigned to perform tasks that could result in internal exposure.

4.14.7. Any DPW shall be issued a primary dosimeter and a backup dosimeter (SRD or ED) if entering an RCA.

4.14.8. Efforts should be made to limit exposures and to avoid any substantial variation above a uniform exposure rate.

4.14.9. Backup dosimeter readings should be tracked by the RPS and DPW on a daily basis.

4.15 Medically-Administered Radioisotopes

4.15.1. Individuals shall inform the RPS, PHP, or the CS RSO prior to donning dosimetry and entering an RCA after any medical treatment or diagnostics in which radionuclides have been administered.

4.15.2. After receiving a medical intake, the individual should provide documentation to the RPS, PHP, or the CS RSO stating the date of treatment, radionuclide used, amount of intake, and medical procedure performed.

4.15.3. The RPS and PHP shall assess any work restrictions that may be necessary until the medical radionuclides have cleared the body to avoid problems with frisking, bioassay measurement, exposure to co-workers, or reporting of non-occupational exposure.

4.15.4. Before re-issuance of a primary dosimeter and allowing the individual access to an RCA, the RPS shall determine if the individual can be cleared by frisking or passing through a personnel contamination monitor (PCM) and obtain authorization from the PHP or CS RSO.

4.16 Dose Assessments

Note: The Corporate Radiation Safety Officer shall be notified of all dose assessments.

4.16.1. External and Internal dose assessments shall be performed in accordance with References 2.8, CS-RS-PR-017, *External Dose Assessments* and 2.9, CS-RS-PR-018, *Internal Dose Assessments*.

4.16.2. Complete a First Notification as required in accordance with Reference 2.3, ES-AD-PR-005, *First Notification*.

4.16.3. External dose assessment should be performed for the following conditions as directed by the PHP and/or CS RSO.

- Hot particle identified on the skin or clothing,
- General skin contamination in excess of 10,000 dpm/100 cm^2,
- Contaminated primary dosimeter,
- Lost or damaged primary or backup dosimeter,
- Off-scale SRD,
- Wrong dosimetry worn,
- Dosimetry not worn properly,
- Entry into an area without required dosimetry,
- Potential over-exposure,
- Declaration of pregnancy,
- As requested by the RPS.

4.16.4. Internal dose assessments should be performed for the following conditions as directed by the PHP and/or CS RSO and approved by a CHP:

- Any positive bioassay result,
- High facial or nasal contamination,
- Entry to airborne radioactivity areas without appropriate exposure controls,
- Spills or potential airborne radioactivity excursions due to process equipment failure,
- Whenever an intake ≥10 DAC hours may have occurred during the work week based on air sampling data,
- Known or suspected incidents of worker ingestion of radioactive material,
- Actual or potentially contaminated wounds or skin absorptions, or
- Evidence of failure of respiratory protection equipment.

4.16.5. A copy of all dose assessments shall be placed in the exposed individual's exposure history file.

4.17 Notifications

4.17.1. In the event that the Energy*Solutions* administrative limits are exceeded, a First Notification shall be made in accordance with Reference 2.3, ES-AD-PR-005, *First Notification* and the individuals work activities restricted to prevent additional dose unless approved by the Corporate Director of Radiation Safety.

4.17.2. In the event that any of the Federally imposed limits are exceeded a First Notification shall be made in accordance with Reference 2.3, ES-AD-PR-005, *First Notification* and the individuals work activities restricted to prevent additional dose and the following performed:

- If the exposure event caused or threatens to cause an individual to exceed 5 times the federally imposed limits within a 24 hour period, the CS RSO shall notify the NRC or applicable regulatory body immediately.
- If the exposure event caused or threatens to cause an individual to exceed the federally imposed limits within a 24 hour period, the CS RSO shall notify the NRC or applicable regulatory body within 24 hours of the event.
- The CS RSO shall submit a written report within 30 days after learning of the over-exposure.
- The CS RSO shall submit a written report within 30 days following NRC notification as listed above in accordance with 10 CFR 20.2202(c) and (d), 2203 and 2205. In addition, a report shall be prepared and submitted to the applicable regulatory body in the event that it is determined through the public dose evaluation at the end of the year and/or field project that a member of the public received an exposure in excess of ALARA limit of 10 mrem TEDE for the year from airborne activity from license operations.

4.18 Records Management

4.18.1. Personnel monitoring records shall be maintained by the CS RSO or designee.

4.18.2. Personnel monitoring records shall be protected from disclosure to individuals or organizations outside Energy*Solutions*, except regulatory agencies, unless written authorization is provided by the individual.

4.18.3. Records of individual monitoring shall be maintained on NRC Form 5, Attachment 5.6 or equivalent. These records shall be updated at least annually and no later than April 30th of the following year.

4.18.4. Dose records and reports are only required for the monitoring periods for which monitoring was performed. Where monitoring was performed but not required by this procedure or by applicable regulations, no record or reports are required. However, it is a good practice to maintain such records.

4.18.5. An annual summary report of the individual radiation dose received at Energy*Solutions* facilities/projects shall be sent to each worker who received an occupational dose in excess of 100 mrem (1 mSv) TEDE or 100 mrem (1 mSv) to any individual organ or tissue and upon request by the individual.

4.18.6. A written exposure report shall be provided to the individual within 30 days of the request.

4.18.7. Records of embryo/fetus dose shall be maintained with those of the mother along with the declaration of pregnancy and any dose assessments that were performed.

4.18.8. All exposure reports issued to individuals shall contain the following statement as required by 10CFR19.13:

"This report is furnished to you under the provisions of the Nuclear Regulatory Commission 10CFR Part 19. You should preserve this report for future reference."

4.18.9. If work was performed under a client's license, dose records will remain with the facility licensee upon completion of the project and maintained in accordance with their procedures.

4.18.10. Dosimetry records will be stored on site and available for review upon request. Any records with personal information will be stored in a locked file cabinet.

4.18.11. A public dose evaluation shall be performed in accordance with Section 4.13, documented and maintained with the license records.

5.0 ATTACHMENTS AND FORMS

5.1 Occupational Exposure Limits

5.2 Occupational Exposure History Request

5.3 Dosimetry Issue Request

5.4 Declaration of Pregnancy

5.5 Visitor Access Log (Example)

5.6 NRC Form 5

(Attachment 5.1) **Occupational Exposure Limits**

Category	Exposure Limit (mrem/yr)				
	Whole Body	**Lens of the Eye**	**Organ**	**Skin and Extremity**	**Extension Approval**
Federally-Imposed					
Occupational – Adult	5,000	15,000	50,000	50,000	NA
Occupational – Minor	500	1,500	5,000	5,000	NA
Declared Pregnant Worker	500	NA	NA	NA	NA
Visitor	100	NA	NA	NA	NA
Energy*Solutions* Administrative Limits					
Occupational – Adult	2,500	7,500	25,000	25,000	NA
Occupational – Minor	NA	NA	NA	NA	NA
Declared Pregnant Worker	400	NA	NA	NA	NA
Visitor	100	NA	NA	NA	NA
Commercial Services Administrative Limits *					
Occupational – Adult	1,500	4,500	15,000	15,000	CS RSO
	2,000	6,000	20,000	20,000	RSC
Occupational – Minor	NA	NA	NA	NA	NA
Declared Pregnant Worker	400 (40 mrem / month)	NA	NA	NA	NA
Visitor	100	NA	NA	NA	NA

* Approvals are required to exceed the Commercial Services Administrative Limits as specified; however, the corporate Energy*Solutions* administrative limits shall not be knowingly exceeded.

(Attachment 5.2) Occupational Exposure Request

(Privacy Act Information)

Date: _____

TO: _____

_____

_____

The individual as specified below has indicated that he/she was monitored and may have received an occupational radiation exposure while employed or working at your facility. So that we may compile the appropriate radiation history for the individual, we request your cooperation in providing us with any exposure history that you may have, specifically for the monitoring period as indicated by the individual.

Name: _____ SSN: _____

Monitoring Period: _____ DOB: _____

Please address your reply as follows:

Energy*Solutions*
Attn: Radiation Safety Officer
1009 Commerce Park Drive, Suite 100
Oak Ridge, TN 37830
Phone Number:

I hereby authorize the release of the above information to Energy*Solutions*.

_____ _____

Employee Signature Date

(Attachment 5.3) **Dosimetry Issue Request**

Personnel Information	
Name:	Mailing Address:
SSN:	
DOB:	
Employer:	Work Address:
Employee ID:	
Work Location:	

Occupational Exposure Information		
Have you ever been monitored for occupational exposure to radiation by film badge, TLD or OSL by anyone?	☐ Yes	☐ No
Have you been monitored for occupational exposure to radiation during the current calendar year?	☐ Yes	☐ No
Have you ever been previously monitored for occupational exposure to radiation by Energy*Solutions*?	☐ Yes	☐ No
Note: If you answered yes to any of the questions above, please list the applicable information for each facility at which you were monitored for exposure on the following pages. For individuals likely to receive less than 100 mrem in a calendar year on a project only current year dose information is needed.		

Training	
Radiation Worker Training: ☐ GERT ☐ RW I ☐ RW II (Respirator)	Date:
Company:	
BY SIGNING BELOW, I ACKNOWLEDGE THAT ALL INFORMATION PROVIDED ON THIS FORM IS TRUE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.	
Signature:	Date:

Approval	
Dosimeter: ☐ WB TLD ☐ Extremity ☐ DRD/SRD/ED	SN:
Signature:	Date:

(Attachment 5.3) Dosimetry Issue Request (continuation)

List all facilities where you were monitored during the current year and any estimated or record doses. If you have copies of your dose of record, please include copies as applicable.

Facility	Exposure (mrem)
Name and Address:	Whole Body (DDE) ___________ Shallow Dose (SDE) ___________ Lens Dose (LDE) ___________ Extremity Dose ___________ Internal Dose (CEDE) ___________
Monitoring Period:	☐ DLR (Record) ☐ Estimate
Name and Address:	Whole Body (DDE) ___________ Shallow Dose (SDE) ___________ Lens Dose (LDE) ___________ Extremity Dose ___________ Internal Dose (CEDE) ___________
Monitoring Period:	☐ DLR (Record) ☐ Estimate
Name and Address:	Whole Body (DDE) ___________ Shallow Dose (SDE) ___________ Lens Dose (LDE) ___________ Extremity Dose ___________ Internal Dose (CEDE) ___________
Monitoring Period:	☐ DLR (Record) ☐ Estimate
Name and Address:	Whole Body (DDE) ___________ Shallow Dose (SDE) ___________ Lens Dose (LDE) ___________ Extremity Dose ___________ Internal Dose (CEDE) ___________
Monitoring Period:	☐ DLR (Record) ☐ Estimate
Name and Address:	Whole Body (DDE) ___________ Shallow Dose (SDE) ___________ Lens Dose (LDE) ___________ Extremity Dose ___________ Internal Dose (CEDE) ___________
Monitoring Period:	☐ DLR (Record) ☐ Estimate

By signing below, I acknowledge that all the information as provided on this form is true and accurate to the best of my knowledge.

Signature:	Date:

(Attachment 5.4) Declaration of Pregnancy

SECTION I (Originator)	
Name: _____ Department: _____	
Estimated Date of Conception: _____	
Estimated Date of Birth: _____	
Declaring Individual's Signature: _____ Date: _____	
SECTION II (Supervisor Acknowledgment)	
I acknowledge that the above named individual has formally declared her pregnancy. As a result, more stringent occupational dose limits will apply. No further entry into airborne radioactivity areas or high radiation areas will be allowed until after the gestation period has ended. I understand work assignments shall not require access to any RCAs until her dose margin for the remainder of the pregnancy has been determined.	
Supervisor's Signature: _____ Date: _____	
SECTION III (Dosimetry Use - Prenatal)	
Estimated DDE to the embryo/fetus at the time of declaration:	
Estimated CEDE to the embryo/fetus at the time of declaration:	
Estimated CEDE to the mother at the time of declaration:	
Estimated TEDE to the embryo/fetus at the time of declaration:	
Remaining TEDE margin for the remaining gestation period	
Administrative dose limit:	
CS RSO Signature: _____ Date: _____	
SECTION IV (Dosimetry Use - Postpartum)	
Assigned DDE to the embryo/fetus at delivery:	
Assigned CEDE to the embryo/fetus at delivery	
Assigned TEDE to the embryo/fetus at delivery	
CS RSO Signature: _____ Date: _____	

(Attachment 5.5) **Visitor Access Log (example)**

Full Name	SSN Last 4 Digits	Date	Exposure Information		
			In	Out	Assigned

(Attachment 5.6) **NRC Form 5**

PAGE ____ OF ____

NRC FORM 5 (6-2011) 10 CFR PART 20 — U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO.3150-0006 EXPIRES: 06/30/2014

Estimated burden per response to comply with this mandatory collection request: 20 minutes. This information is used to ensure that doses to individual do not exceed regulatory limits. This information is required to record/annually report individual occupational exposure to radiation to ensure that the exposure does not exceed regulatory limits. Send comments regarding burden estimate to the Information Services Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0008), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

OCCUPATIONAL DOSE RECORD FOR A MONITORING PERIOD

1. NAME (LAST, FIRST, MIDDLE INITIAL)	2. IDENTIFICATION NUMBER	3. ID TYPE	4. SEX ☐ MALE ☐ FEMALE	5. DATE OF BIRTH (MM/DD/YYYY)

6. MONITORING PERIOD (MM/DD/YYYY- MM/DD/YYYY)	7. LICENSEE NAME	8. LICENSE NUMBER(S)	9A. ☐ RECORD ☐ ESTIMATE	9B. ☐ ROUTINE ☐ PSE

INTAKES

10A. RADIONUCLIDE	10B. CLASS	10C. MODE	10D. INTAKE IN μCi

DOSES (in rem)

DEEP DOSE EQUIVALENT	(DDE)	11.
LENS (EYE) DOSE EQUIVALENT	(LDE)	12.
SHALLOW DOSE EQUIVALENT, WHOLE BODY	(SDE,WB)	13.
SHALLOW DOSE EQUIVALENT, MAX EXTREMITY	(SDE,ME)	14.
COMMITTED EFFECTIVE DOSE EQUIVALENT	(CEDE)	15.
COMMITTED DOSE EQUIVALENT, MAXIMALLY EXPOSED ORGAN	(CDE)	16.
TOTAL EFFECTIVE DOSE EQUIVALENT (ADD BLOCKS 11 AND 15)	**(TEDE)**	17.
TOTAL ORGAN DOSE EQUIVALENT MAX ORGAN (ADD BLOCKS 11 AND 16)	**(TODE)**	18.

19. COMMENTS

20. SIGNATURE - LICENSEE	21. DATE PREPARED

INSTRUCTIONS AND ADDITIONAL INFORMATION PERTINENT TO THE COMPLETION OF NRC FORM 5
(All doses should be stated in rems)

1. Type or print the full name of the monitored individual in the order of last name (include "Jr," "Sr," "III," etc.), first name, middle initial (if applicable).

2. Enter the individual's identification number, including punctuation. This number should be the 9-digit social security number if at all possible. If the individual has no social security number, enter the number from another official identification such as a passport or work permit.

3. Enter the code for the type of identification used as shown below:

CODE	ID TYPE
SSN	U.S. Social Security Number
PPN	Passport Number
CSI	Canadian Social Insurance Number
WPN	Work Permit Number
PADS	PADS Identification Number
OTH	Other

4. Check the box that denotes the sex of the individual being monitored.

5. Enter the date of birth of the individual being monitored in the format MM/DD/YYYY.

6. Enter the monitoring period for which this report is filed. The format should be MM/DD/YYYY - MM/DD/YYYY.

7. Enter the name of the licensee.

8. Enter the NRC license number or numbers.

9A. Place an "X" in Record, Estimate, or No Record. Choose "Record" if the dose data listed represent a final determination of the dose received to the best of the licensee's knowledge. Choose "Estimate" only if the listed dose data are preliminary and will be superseded by a final determination resulting in a subsequent report. An example of such an instance would be dose data based on self-reading dosimeter results and the licensee intends to assign the record dose on the basis of TLD results that are not yet available.

9B. Place an "X" in either Routine or PSE. Choose "Routine" if the data represent the results of monitoring for routine exposures. Choose "PSE" if the listed dose data represents the results of monitoring of planned special exposures received during the monitoring period. If more than one PSE was received in a single year, the licensee should sum them and report the total of all PSEs.

10A. Enter the symbol for each radionuclide that resulted in an internal exposure recorded for the individual, using the format "Xx-###x," for instance, Cs-137 or Tc-99m.

10B. Enter the lung clearance class as listed in Appendix B to 10 CFR Part 20.1001-2401 (D, W, Y, V, or O for other) for all intakes by inhalation.

10C. Enter the mode of intake. For inhalation, enter "H." For absorption through the skin, enter "B." For oral ingestion, enter "G." For injection, enter "J."

10D. Enter the intake of each radionuclide in μCi.

11. Enter the deep dose equivalent (DDE) to the whole body.

12. Enter the eye dose equivalent (LDE) recorded for the lens of the eye.

13. Enter the shallow dose equivalent recorded for the skin of the whole body (SDE,WB).

14. Enter the shallow dose equivalent recorded for the skin of the extremity receiving the maximum dose (SDE,ME).

15. Enter the committed effective dose equivalent (CEDE).

16. Enter the committed dose equivalent (CDE) recorded for the maximally exposed organ.

17. Enter the total effective dose equivalent (TEDE). The TEDE is the sum of items 11 and 15.

18. Enter the total organ dose equivalent (TODE) for the maximally exposed organ. The TODE is the sum of items 11 and 16.

19. COMMENTS.
In the space provided, enter additional information that might be needed to determine compliance with limits. An example might be to enter the note that the SDE,ME was the result of exposure from a discrete hot particle. Another possibility would be to indicate that an overexposed report has been sent to NRC in reference to the exposure report.

20. Signature of the person designated to represent the licensee.

21. Enter the date this form was prepared.

PRIVACY ACT STATEMENT

Pursuant to 5 U.S.C. 552a(e)(3), enacted into law by Section 3 of the Privacy Act of 1974 (Public Law 93-579), the following statement is furnished to individuals who supply information to the U.S. Nuclear Regulatory Commission (NRC) on NRC Form 5. This information is maintained in a system of records designated as NRC-27 and described at 75 Federal Register 57354 (September 20, 2010), or the most recent Federal Register publication of the NRC's Systems of Records Notices that is located in NRC's Agencywide Documents Access and Management System (ADAMS).

1. **AUTHORITY:** 5 U.S.C. 7902; 29 U.S.C. 668; 42 U.S.C. 2051, 2073, 2093, 2095, 2111, 2133, 2134, and 2201(o); 10 CFR Part 20; 10 CFR Part 34; Executive Order (E.O.) 9397, as amended by E.O. 13478; E.O. 12196, as amended; E.O. 12399; E.O. 12534; E.O. 12610.

2. **PRINCIPAL PURPOSE(S):** The information is used by the NRC in its evaluation of the risk of exposures to radiation and radioactive materials associated with licensed activities and in exercising its statutory responsibility to monitor and regulate the safety and health practices of its licensees. The data permits a meaningful comparison of both current and long-term exposure experience among types of licensees and among licensees within each type. Data on your exposure to radiation is available to you upon your request.

3. **ROUTINE USE(S):** In addition to the disclosures permitted under subsection (b) of the Privacy Act, this information may be used to provide data to other Federal and State agencies involved in monitoring and/or evaluating radiation exposure received by individuals monitored for radiation exposure while employed by or visiting or temporarily assigned to certain NRC licensed facilities; or to return data provided by licensee upon request. Information may be disclosed in accordance with any of the Routine Uses listed in the Prefatory Statement of General Routine Uses, including to an appropriate Federal, State, local or Foreign agency in the event the information indicates a violation or potential violation of law; in the course of an administrative or judicial proceeding; to an appropriate Federal, State, local and foreign agency to the extent relevant and necessary for an NRC decision about you or to the extent relevant and necessary for that agency's decision about you; in the course of discovery under a protective order issued by a court of competent jurisdiction, and in presenting evidence; to a Congressional office to respond to their inquiry made at your request; to NRC-paid experts, consultants, and others under contract with the NRC, on a need-to-know basis; or to appropriate persons and entities for purposes of response and remedial efforts in the event of a suspected or confirmed breach of data from this system of records.

4. **WHETHER DISCLOSURE IS MANDATORY OR VOLUNTARY AND EFFECT ON INDIVIDUAL OF NOT PROVIDING INFORMATION:** It is voluntary that you furnish the requested information, including the Social Security number (SSN) in block #2. The SSN is used to assure that NRC has an accurate and unique identifier not subject to the coincidence of similar names or birth dates among the large number of persons on who data is maintained. The licensee must complete NRC Form 5 on each individual for whom personnel monitoring is required under 10 CFR 20.1502. In addition, licensees must submit this information to NRC in accordance with the requirement under 10 CFR 20.2206. Failure to do so may subject the licensee to enforcement action in accordance with 10 CFR 20.2401.

5. **SYSTEM MANAGER AND ADDRESS:** REIRS Project Manager, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.