Personnel Monitoring

Nuclear Secured / Radiation Safety

NS-RS-PR-500, 0

Date Effective: 11 August 2019

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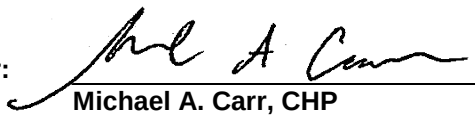
History and Approvals

History

Revision	Intent Y/N	Purpose description
0	Y	For Issue (Rebranded CS-RS-PR-010)

Approvals

Preparer: 

8/5/2019

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8/14/2019

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Chapter Pages

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1. Purpose and Scope

Personnel monitoring is necessary to ensure the accurate tracking and measurement of personnel dose and to help ensure that regulatory imposed exposure limits as well as the Nuclear Secured (NS) 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 NS Radiation Protection Program (RPP) to ensure proper personnel monitoring for radiation exposure and for establishing and maintaining accurate exposure records.

1.2. Scope

This procedure is for the exclusive use of Nuclear Secured personnel and subcontractors at field projects where NS has the primary role in controlling exposures to on-site personnel under the NS RPP. For projects in which NS does not provide the primary role for personnel monitoring, NS will request the personnel monitoring histories and exposure records as applicable to ensure personnel exposure to NS project personnel and subcontractors are maintained in accordance with this procedure.

2. References

2.1. 10CFR19.13, *Notices and Reports to Individuals*.

2.2. 10CFR20, *Standards for Protection Against Radiation.*

2.3. AE-SH-PR-002, *Incident Reporting and Notification*

2.4. NS-RS-PG-001, *Radiation Protection Program*

2.5. NS-RS-PR-102, *Project Records Management*

2.6. NS-RS-PR-501, *Air Sampling and Analysis*

2.7. NS-RS-PR-502, *Bioassay Sampling*

2.8. NS-RS-PR-503, *External Dose Assessment*

2.9. NS-RS-PR-504, *Internal Dose Assessments*

2.10. NS-RS-PR-505, *DAC-Hr Tracking*

3. 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 Nuclear Secured for the purpose of maintaining radiation dose below regulatory limits.

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)* - Making every reasonable effort to maintain exposures to radiation as far below the dose limits as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to the state of technology, the economics of improvements in relation to benefits to public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest.

3.1.5. *Annual Limit on Intake (ALI)* – The derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year, ALI is the smaller value of intake of a given radionuclide in a year by reference man that would result in a committed effective dose equivalent (CEDE) of 5 rem or a committed dose equivalent of 50 rem to any individual organ or tissue.

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, in some cases, the locations 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; $H_{T,50}$)* - 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 intake.

3.1.9. *Committed Effective Dose Equivalent (CEDE; $H_{E,50}$)* - 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 the licensee, in writing, of her pregnancy and the estimated date of conception.

3.1.12. *Deep Dose Equivalent (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 which, 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 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. *Dose Limit* - The permissible upper bounds of radiation doses.

3.1.19. *Effective Dose Equivalent (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 ($H_E = \Sigma W_T * H_T$).

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

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

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

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

3.1.24. *Gray (Gy)* – The SI unit of absorbed dose. One gray is equal to an absorbed dose of 1 Joules per Kilogram (100 rad).

3.1.25. *Individual Monitoring* – (1) The assessment of dose equivalent by the use of devices designed to be worn by the individual; (2) The assessment of committed effective dose equivalent by bioassay or by determination of the time-weighted air concentrations to which and individual has been exposed, i.e, DAC-hours; (3) The assessment of dose equivalent by the use of survey data.

3.1.26. *Individual monitoring device* - A device designed to be worn by a single individual for the assessment of dose equivalent, such as film badge, thermo luminescence dosimeter (TLD), pocket ionization chambers, and personal ("lapel") air sampling devices.

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

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

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

3.1.30. *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).

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

3.1.32. *Minor* – An individual less than 18 years of age.

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

3.1.34. *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.

3.1.35. *Occupational Dose* - The dose received by an individual during the course of employment in which the individual's assigned duties involve exposure to radiation or to radioactive materials from licensed and unlicensed sources of radiation, whether in the possession of the licensee or other person. Occupational dose does not include doses received from background radiation, from any medical administration the individual has received , from exposure to individuals administered radioactive materials and released under §35.75, from voluntary participation in medical research programs, or as a member of the public.

3.1.36. *Official Dose (Dose of Record)* - 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 on calculations from bioassay results or air sample analysis and exposure period, from survey data and/or other recognized techniques.

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

3.1.38. *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.

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

3.1.40. *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.

3.1.41. *Public Dose* - Dose received by a member of the public from exposure to radiation or to radioactive material released by a licensee, or to any other source of radiation under control of the licensee. Public dose does not include occupational dose or doses received from background radiation, from any medical administration the individual has received , from exposure to individuals administered radioactive materials and released under §35.75, or from voluntary participation in medical research programs.

3.1.42. *Quality Factor (Q)* - The modifying factor used to derive dose equivalent from absorbed dose. Quality factors are listed in the tables as provided in 10 CFR 20.1004.

3.1.43. *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).

3.1.44. *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).

3.1.45. *Restricted Area* - Any area to which access is limited by the licensee for the purpose of protecting individuals against undue risk from exposure to radiation and radioactive materials.

3.1.46. *Self-Reading Dosimeter (SRD)* - A monitoring device consisting of a collection chamber coupled with an optical lens and calibrated scale or a detector coupled with

an electronic (e.g., digital) display. 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).

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

3.1.48. *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)

3.1.49. *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.

3.1.50. *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

3.1.51. *Visitor* - Any non-NS employee or any NS employee or subcontractor not qualified as a Radiation Worker who requires access to a Restricted Area.

3.1.52. *Whole body* – A person's head, trunk (including male gonads), arms above the elbow, or legs above the knee.

3.2. Responsibilities

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

3.2.1. NS Radiation Safety Officer

The NS Radiation Safety Officer (RSO) maintains and oversees the implementation of the NS RPP. The 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 RSO is also responsible for the review of all personnel exposure records and to ensure exposures are maintained below regulatory and NS administrative limits as applicable.

3.2.2. 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 the NS RPP and client programs and procedures, as applicable, are available for use by project personnel.

3.2.3. Project Health Physicist

The Project Health Physicist (PHP) is responsible for assisting the RSO with the review of personnel exposure records and providing health physics support to the PM and Radiation Protection Supervisor (RPS). This includes technical support to ensure procedural and regulatory compliance. 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 personnel exposure and bioassay reports, and evaluating the need for using multiple whole body, neutron and extremity dosimeters.

3.2.4. Radiation Protection Supervisor

The Radiation Protection Supervisor (RPS) manages and oversees the project personnel in regard to radiation and respiratory protection and reports directly to both the PM and the RSO. The RPS is responsible for implementing the NS RPP at the project location and includes the following as applicable to personnel monitoring:

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

The RPS is also responsible for tracking personnel exposures on the project site and providing the PHP and/or RSO with the applicable personnel exposure records as applicable for the project.

3.2.5. 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. Project personnel are also responsible for safety at the project site including radiation safety and have the responsibility for maintaining exposures to themselves and their peers to ALARA. Each individual has the ability and responsibility to stop work as necessary and to bring any safety issues including radiation safety to the attention of the RPS, PM, and/or the RSO.

3.3. Precautions and Limitations

3.3.1. Dosimeters should be protected from physical abuse and harsh environments including excessive heat and water.

3.3.2. Dosimetry shall not be tampered with or opened except by authorized personnel.

3.3.3. Dosimetry should not be x-rayed.

3.3.4. Documents containing PII shall be controlled to prevent disclosure to unauthorized personnel. Hard copy records shall be locked and electronic records password protected to limit access to authorized personnel only.

4. Pre-Requisites / Requirements

4.1. The PHP and/or RSO should perform a prospective evaluation in accordance with Section 5.2 to assess the exposure pathways and to determine if personnel monitoring is required. If a prospective evaluation is not performed, all personnel entering a Restricted Area shall be monitored.

4.2. 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.

4.3. Personnel who may be exposed in excess of 200 DAC-Hrs or 10% of the ALI over the project duration or greater than 10 DAC-Hrs in any one week shall be routinely monitored for internal exposure.

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

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

4.6. NRC regulations in 10 CFR 20 require that primary dosimeter vendors hold current personnel dosimetry NVLAP accreditation.

4.7. Projects using the NS 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.

4.8. All personnel entering a high radiation or very high radiation area shall be monitored for external occupational dose.

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4.9. All personnel who wear respiratory protection for the protection against airborne radionuclides shall be routinely monitored for internal exposure either by bioassay sampling (in-vivo or in-vitro) or DAC-Hr tracking.

4.10. The PHP and RSO shall be notified of any individual reaching 80% of an applicable exposure limit. Any additional dose to the individuals shall be controlled more closely, with additional monitoring such as electronic dosimeters to ensure exposure limits are not exceeded.

5. Procedure

5.1. Exposure Limits

5.1.1. The limits for personnel exposure are provided in Attachment 7.1 as imposed by Federal regulations including the NS administrative limits.

5.1.2. The federally-imposed annual exposure limit for the general public and non-occupationally exposed workers is 100 mrem. This includes:

- General public outside the site boundary,
- General public allowed access to the site (i.e., visitors), and
- Non-occupationally exposed workers.

5.1.3. It is NS' policy that minors under the age of 18 shall not receive occupational exposure.

5.2. Prospective Evaluation

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

5.2.2. Determine if there is an external and/or internal exposure concern and whether personnel exposure may exceed 10% of the regulatory exposure limits 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 results, and

- Professional judgment.

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

5.2.4. 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 air monitoring.

5.2.5. If personnel monitoring is not required and a subsequent evaluation shows that an 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.

5.3. Exposure History Request

5.3.1. For projects in which NS 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 7.2 and provide the form to the PM. The PM shall submit the completed forms to the applicable program manager responsible for personnel monitoring authorizing the release of the monitoring records to the RSO or designee.

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

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

5.3.4. If the individual does not have the exposure records, the individual shall complete the exposure request form, Attachment 7.2, and sign the form authorizing the release of the records to the RSO or designee.

5.3.5. 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.

5.3.6. 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.

5.3.7. 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.

5.3.8. The 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.

5.3.9. If the current year 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.

5.4. Dosimetry Issue

5.4.1. Any individual entering Restricted Area shall be issued primary dosimetry unless a prospective evaluation has been documented indicating that monitoring is not required in accordance with Section 5.2.

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

5.4.3. The RPS and/or PHP will determine the number and type of dosimetry required and contact the RSO or designee to order the dosimetry. The RPS and/or PHP should provide the following information for each individual:

- Name
- SSN
- Birth Date
- Mailing Address

5.4.4. Depending on 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

5.4.5. 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 7.3 or equivalent, prior to dosimetry issue and review the form for completeness, accuracy, and legibility.

5.4.6. 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.
- NAVLAP accredited for the types of radiation and energies to be monitored.

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

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

5.4.9. All assigned dosimetry shall be retained at an appropriate access control point or centralized storage area away from any Restricted Areas when not worn and should not to be removed from site.

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

5.4.11. All issued dosimetry shall be worn at all times while the individual is within any Restricted Area.

5.4.12. Primary dosimeters shall be changed out in accordance with Section 5.8 as appropriate.

5.4.13. Primary dosimeters shall be processed by a NVLAP accredited laboratory or vendor as follows:

- After routine exchange,
- When individual monitoring is no longer required,
- On 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, PHP or RSO.

5.5. Backup Dosimetry

5.5.1. Backup dosimetry, including 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 has reached 80% or an administrative limit or is anticipated to approach the limit;
- Personnel exposures are expected to exceed 10 mrem/day;
- Dose rate fields are not well characterized;

- Dose rates may change significantly as a result of work performed a Restricted Area; or
- Entries into High Radiation Areas and Very High Radiation Areas.

5.5.2. Charged fiber SRDs should read less than ¼ of full scale on issuance and should be re-zeroed before reaching ¾ scale.

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

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

5.5.5. All backup dosimeter readings shall be recorded on the RWP access log or dose tracking system when entering and exiting a Restricted Area.

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

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

5.5.8. 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 any Restricted Area.

5.5.9. In the event of an off-scale backup dosimeter, the RPS shall notify the PM and RSO, and initiate an exposure investigation and an external dose assessment in accordance with Section 5.15, submit a First Notification in accordance with AE-SH-PR-002, *Incident Reporting and Notification*, and make any necessary regulatory notifications as outlined in Section 5.16 as applicable.

5.6. Multiple and Extremity Dosimetry

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

5.6.2. Multiple dosimeters should be worn for non-uniform dose fields in which the dose to portions of the whole body may vary by more than 10% of the applicable dose limit.

5.6.3. 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 may include:

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

5.6.4. 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.

5.7. Wearing Dosimetry

5.7.1. Dosimetry shall be worn in accordance with the Radiation Work Permit (RWP).

5.7.2. 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.
- When shallow dose is of concern, ensure the dosimeter windows (e.g., beta window) are not covered.

5.7.3. 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.

5.8. Dosimetry Exchange

5.8.1. On 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 RSO.

5.8.2. The RPS shall exchange dosimetry on the first day of the new monitoring period.

5.8.3. The RPS should forward a copy of the issue form to the RSO.

5.8.4. 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.

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

5.8.6. An electronic dosimeter may be added to the dosimetry shipment to aid in alerting the vendor on receipt of the shipment to any high readings that may have occurred while in transit.

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

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

5.9. Lost or Damaged Dosimetry

5.9.1. If a primary dosimeter is lost or damaged within a Restricted Area, 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 Restricted Area.

5.9.2. In the event of lost or damaged primary dosimeter, the RPS shall notify the PM and RSO and initiate an exposure investigation and an external dose assessment in accordance with Section 5.15, submit a First Notification in accordance with AE-SH-PR-002, *Incident Reporting and Notification*, and make any necessary regulatory notifications as outlined in Section 5.16 as applicable.

5.10. Internal Exposure Monitoring

5.10.1. 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 NS Respiratory Protection Program is implemented due to the potential for airborne radioactive materials, or

- As required by the PHP and/or site-specific requirements.

5.10.2. Establish an appropriate air monitoring program in accordance with NS-RS-PR-501, *Air Sampling and Analysis*

5.10.3. Internal dose monitoring may be performed either through bioassay monitoring in accordance with NS-RS-PR-502, *Bioassay Sampling*, or via DAC-Hr tracking in accordance NS-RS-PR-505, *DAC-Hr Tracking*.

5.10.4. If bioassay monitoring is required by the PHP and/or RSO, the bioassay monitoring program may include:

5.10.4.1. Routine monitoring at specified intervals when there is a potential for an intake. This includes baseline sampling/measurement to document any pre-existing intake, periodic measurements to assess any potential intakes, and a final bioassay when terminating employment or completion of work assignment.

5.10.4.2. Confirmatory monitoring 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.

5.10.4.3. Special monitoring 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.

5.10.5. All internal monitoring protocols shall be approved by a qualified individual (e.g., Certified Health Physicist) to ensure adequate detection sensitivities and monitoring frequencies.

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

5.10.7. All positive bioassay results shall be reviewed by a qualified individual and an internal dose assessment performed in accordance with NS-RS-PR-504, *Internal Dose Assessments*.

5.11. Visitor Monitoring

5.11.1. 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.

5.11.2. Visitors shall not be granted unescorted access to a Restricted Area; however, they may be granted escorted access with approval from the RSO or PHP.

5.11.3. 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.

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

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

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

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

5.11.7. 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.

5.11.8. 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 of record.

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

5.11.10. If a visitor's backup dosimeter is off-scale or lost, notify the PM, RPS and RSO, initiate an exposure investigation and an external dose assessment in accordance with Section 5.15, submit a First Notification in accordance with AE-SH-PR-002, *Incident Reporting and Notification*, and make any necessary regulatory notifications as outlined in Section 5.16 as applicable. 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.

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

5.11.12. If the total cumulative or single exposure for any visitor is 50 mrem or greater, personnel shall notify the RSO who shall initiate a First Notification in accordance with AE-SH-PR-002, *Incident Reporting and Notification*, and make any necessary regulatory notifications as outlined in Section 5.16 as applicable.

5.12. Public Monitoring

5.12.1. 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 5.1, (i.e., 100 mrem/year).

5.12.2. 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.

5.12.3. 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.

5.12.4. Occupancy factors may be applied as necessary to document compliance.

5.12.5. A public dose assessment shall 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/or RSO.

5.13. Declared Pregnant Worker (DPW)

5.13.1. 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 RSO by use of a Declaration of Pregnancy Form (Attachment 7.4 or equivalent) including the estimated date of conception.

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

5.13.3. On declaration, the PHP and/or RSO shall perform a dose assessment in accordance with Section 5.15 in order to assess any prior dose to the embryo/fetus between the dates of conception and declaration.

5.13.4. The PHP and/or 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 Attachment 7.1, are not exceeded.

5.13.5. 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.

5.13.6. 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.

5.13.7. Any DPW shall be issued a primary dosimeter and a backup dosimeter (SRD or ED) if entering a Restricted Area.

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

5.13.9. Backup dosimeter readings should be tracked by the RPS on a daily basis.

5.14. Medically Administered Isotopes

5.14.1. Individuals shall inform the RPS, PHP, or the RSO prior to donning dosimetry and entering a Restricted Area after any medical treatment or diagnostics in which radionuclides have been administered.

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

5.14.3. 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, exposure of stored dosimetry, or reporting of non-occupational exposure.

5.14.4. Before re-issuance of a primary dosimeter and allowing the individual access to a Restricted Area, 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 RSO.

5.15. Dose Assessments

5.15.1. Complete a First Notification as required in accordance with AE-SH-PR-002, *Incident Reporting and Notification*.

5.15.2. External dose assessment should be performed for the following conditions as directed by the PHP or RSO in accordance with NS-RS-PR-503, *External Dose Assessment*.

- 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,
- Potential over-exposure,
- Declaration of pregnancy,
- As requested by the RPS.

5.15.3. Internal dose assessments should be performed for the following conditions as directed by the PHP and/or RSO in accordance with NS-RS-PR-504, *Internal Dose Assessments*.

- Any positive bioassay result,
- Facial or nasal contamination above personnel contamination limits,
- 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.

5.15.4. All dose assessments shall be independently reviewed and approved by a qualified individual (e.g., Certified Health Physicist).

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

5.16. Notifications

5.16.1. In the event that the NS administrative limits are exceeded, a First Notification shall be made in accordance with AE-SH-PR-002, *Incident Reporting and Notification*and the individuals work activities restricted to prevent additional dose unless approved by the RSO and the Senior Vice President of Nuclear Secured.

5.16.2. In the event that any of the regulatory imposed limits are exceeded a First Notification shall be made in accordance with AE-SH-PR-002, *Incident Reporting and Notification*, , the individuals work activities restricted to prevent additional dose and the following notifications performed in accordance with NS-RS-PG-001, *Radiation Protection Program*:

- 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 RSO shall notify the NRC and/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 RSO shall notify the NRC or applicable regulatory body within 24 hours of the event.
- The RSO shall submit a written report within 30 days after learning of the over-exposure.
- The RSO shall submit a written report within 30 days following NRC notification as listed above in accordance with 10CFR20.2202(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.

5.16.3. Copies of any notifications shall be provided to any involved personnel.

5.17. Records Management and Reporting

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

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

5.17.3. Records of individual monitoring shall be maintained on NRC Form 5, Attachment 7.5 or equivalent. These records shall be updated at least annually and no later than April 30th of the following year.

5.17.4. 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.

5.17.5. An annual summary report of the individual radiation dose received on NS field 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 on request by the individual.

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

5.17.7. 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.

5.17.8. 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."

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

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

5.17.11. A public dose evaluation shall be performed in accordance with Section 5.12, documented and maintained with the license records.

6. Records

6.1. Prospective Evaluation

6.2. Occupational Exposure History Request

6.3. Dosimetry Issue / Request Form

6.4. Pregnancy Declaration

6.5. Visitor Access Log

6.6. Back-up Dosimetry and RWP Entry Logs

6.7. NRC Form 5

6.8. Personnel Exposure and Bio-assay Reports

6.9. DAC-Hr Tracking Logs

6.10. Air Sample Results and Analyses

6.11. Internal and External Dose Evaluations

6.12. Personnel Contamination Reports

6.13. Public Dose Evaluation

7. Appendices and Forms

7.1. Exposure Limits

7.2. Occupational Exposure History Request

7.3. Dosimetry Issue Form

7.4. Declaration of Pregnancy

7.5. NRC Form 5

Attachment 7.1 **Exposure Limits**

Category	Exposure Limit (mrem/yr)				
	Whole Body	Lens of the Eye	Organ	Skin and Extremity	Extension Approval
United States Federally Imposed Limits					
Adult	5,000	15,000	50,000	50,000	NA
Minor (< 18 years of age)	500	1,500	5,000	5,000	NA
Declared Pregnant Worker	500	NA	NA	NA	NA
Undetermined History	100	NA	NA	NA	NA
Visitor	100	NA	NA	NA	NA
NS Administrative Limits[a, b]					
Adult	2,500	7,500	25,000	25,000	NA
Minor (< 18 years of age)	NA	NA	NA	NA	NA
Declared Pregnant Worker	400	NA	NA	NA	NA
Undetermined History	100	NA	NA	NA	NA
Visitor	100	NA	NA	NA	NA

a Approvals are required to exceed the NS Administrative Limits as specified.

b International administrative limits will be established at 80% of the applicable regulatory limit.

Attachment 7.2 **Occupational Exposure History 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:

Atkins Nuclear Secured
Attn: Radiation Safety Officer
545 Oak Ridge Turnpike
Oak Ridge, TN 37830
Phone Number:

I hereby authorize the release of the above information to Atkins Nuclear Secured.

_____ _____

Employee Signature Date

Attachment 7.3 **Dosimetry Issue Form**

Personnel Information (PII)	
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 Atkins?	☐ Yes ☐ No
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.	

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 7.3 **Dosimetry Issue Form (Continued)**

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: Monitoring Period:	Whole Body (DDE) ___________ Shallow Dose (SDE) ___________ Lens Dose (LDE) ___________ Extremity Dose ___________ Internal Dose (CEDE) ___________ ☐ DLR (Record) ☐ Estimate
Name and Address: Monitoring Period:	Whole Body (DDE) ___________ Shallow Dose (SDE) ___________ Lens Dose (LDE) ___________ Extremity Dose ___________ Internal Dose (CEDE) ___________ ☐ DLR (Record) ☐ Estimate
Name and Address: Monitoring Period:	Whole Body (DDE) ___________ Shallow Dose (SDE) ___________ Lens Dose (LDE) ___________ Extremity Dose ___________ Internal Dose (CEDE) ___________ ☐ DLR (Record) ☐ Estimate
Name and Address: Monitoring Period:	Whole Body (DDE) ___________ Shallow Dose (SDE) ___________ Lens Dose (LDE) ___________ Extremity Dose ___________ Internal Dose (CEDE) ___________ ☐ 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 7.4 **Declaration of Pregnancy**

SECTION I (Originator)	
Name	
Estimated Date of Conception	
Estimated Date of Birth	
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 Restricted Area until her dose margin for the remainder of the pregnancy has been determined.	
Supervisor 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:	
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	
RSO Signature / Date:	

Attachment 7.1 **NRC Form 5**

PAGE _____ OF _____

NRC FORM 5
(10 2017)
10 CFR PART 20

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0006 EXPIRES: 10/31/2020

Estimated burden per response to comply with this mandatory collection request: 20 minutes. This information is used to ensure that doses to individuals do not exceed regulatory limits. This information is required to record and 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-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to mocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0006), 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				DOSES (in rem)		
10A. RADIONUCLIDE	10B. CLASS	10C. MODE	10D. INTAKE IN µCi			
				EFFECTIVE DOSE EQUIVALENT (FOR EXTERNAL EXPOSURES)	(EDEX)	11A.
				DEEP DOSE EQUIVALENT (FOR THE ENTIRE MONITORING PERIOD)	(DDE)	11B.
				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 11A AND 15)	**(TEDE)**	17.
				TOTAL ORGAN DOSE EQUIVALENT MAX ORGAN (ADD BLOCKS 11B AND 16)	**(TODE)**	18.
				19. COMMENTS		

20. SIGNATURE - LICENSEE	21. DATE PREPARED

NRC FORM 5 (10-2017)