environmental properties management, LLC	**Cimarron Environmental Response Trust**	
	RADIATION PROTECTION PLAN	
Document No. RPP-001	Rev. 4	Effective date:

REVIEW AND APPROVALS	
Reviewed by Quality Assurance Coordinator: Charles Beatty	
Signature:	Date:
Approved by Radiation Safety Officer: Jay Maisler, CHP	
Signature:	Date:
Approved by Project Manager: Jeff Lux	
Signature:	Date:
Approved by Administrator, Cimarron Environmental Response Trust: Bill Halliburton	
Signature:	Date:

NOTE: THE EFFECTIVE DATE WILL BE DETERMINED FOLLOWING NRC APPROVAL OF THE LICENSE AMENDMENT REQUEST.

Summary of Changes

Revisions to this document will be identified, and revisions or addenda will be issued as needed. The Project Manager maintains the signed original of this document; no controlled copies are issued. The end user is responsible to verify with the Project Manager that any hard copy being referenced is the current revision. A summary description of each revision or addenda will be noted in the following table.

Revision Number	Date	Comments
Rev. 0	April 11, 2011	Original
Rev. 1	Feb. 3, 2012	Revision 1 to the Cimarron Radiation Protection Plan contains numerous administrative changes and editorial changes. Specific changes are identified in a separate 27(e) evaluation and attached markup of changes from RPP Rev. 0.
Rev. 2	Feb. 24, 2014	Revision 2 to the RPP includes clarifications addressing groundwater processing and editorial changes. Specific changes are identified in a separate 27(e) evaluation and attached markup of changes from Rev. 1.
Rev. 3	April 15, 2016	Revision 3 provides changes to support the proposed Decommissioning Plan and includes editorial changes. Clarifications were added to address how radiological controls for routine activities are handled when an Activity Plan is not required or used. Specific changes are identified in a separate 27(e) evaluation and attached markup of changes from Rev. 2.
Rev. 4	TBD	Revision 4 incorporates changes for consistency with the Cimarron Facility Decommissioning Plan, Rev. 1 and includes editorial changes.

TABLE OF CONTENTS

1.0 INTRODUCTION

1.3 Purpose

This Radiation Protection Plan (RPP) establishes radiation protection requirements implemented at the Cimarron Site to achieve compliance with applicable regulatory requirements and License SNM-928. As provided in the Site Decommissioning Plan, the RPP will be implemented during decommissioning (extraction and treatment of uranium-impacted groundwater), specifically related to radiation safety controls and monitoring for workers.

1.2 Scope

The RPP applies to all radiological operations, routine and emergency, at the Cimarron Site. The RPP applies to the following personnel when present at the Cimarron Site:

- Licensee employees
- Contractors and their employees
- Visitors, when work involves radioactive material, under the supervision of trained personnel as authorized by the Radiation Safety Officer (RSO)

1.3 License Transfer

The U.S. Nuclear Regulatory Commission (NRC) transferred the license (SNM-928) for the Cimarron Site (the Site) to the Cimarron Environmental Response Trust (licensee) on February 14, 2011. The license is administered by the Trustee, Environmental Properties Management, LLC (EPM). EPM's maintenance of the Site and administration of the Site in accordance with License SNM-928 will provide adequate protection of the public health and safety and reasonable assurance of compliance with the NRC's regulations.

2.0 TRAINING REQUIREMENTS AND POLICY

2.1 Section Overview

This section describes radiation safety training requirements for individuals who enter a Restricted Area, handle radioactive material, or work in the vicinity of radioactive material at the Site.

2.2 Responsibilities

The Radiation Safety Officer (RSO) is responsible for the radiation safety training program which includes:

- Approving radiation safety training materials
- Approving personnel conducting radiation safety training
- Performing radiation safety training or approving other individuals to perform the training
- Verifying that those individuals who require radiation safety training receive appropriate training

2.3 Training Requirements

Radiation Safety Training requirements are tiered to provide an appropriate level of training based on the type of radiological work an individual will perform at the Cimarron Site. The Licensee shall not assume that radiation safety training has been adequately covered by prior employment or academic training.

Inspectors and representatives of the Nuclear Regulatory Commission (NRC) and the Oklahoma Department of Environmental Quality, Land Protection Division, Radiation Management Section are exempt from radiation safety training. Site specific information may be provided to agency personnel if deemed necessary by the RSO.

Ancillary personnel (e.g., clerical, housekeeping, security, etc.) whose duties may require them to work in the vicinity of radioactive material (escorted or not) shall receive information about radiation hazards and the appropriate precautions.

A prospective evaluation of radiological conditions and potential doses to workers for the groundwater treatment process will be performed. Based on the results of this evaluation, the RSO will determine the need for individual monitoring, and General or Site Specific Training (section 2.3.2) or Radiation Worker Training (section 2.3.3) for workers accessing Restricted Areas, and the boundaries of any required Restricted Area(s).

2.3.1 Radiological Orientation

Radiological Orientation is provided for individuals performing routine activities that do not require access into Restricted Areas other than Radioactive Materials Areas, but does not include working with or handling radioactive materials. Activities these individuals undertake include general office work, housekeeping, tours and inspections of the property, annual environmental monitoring campaigns, and installation of new monitoring wells.

Radiological Orientation is required prior to individuals who are permitted unescorted access to the Cimarron Site. Information required for Radiological Orientation may be presented in a classroom setting or provided as a "read-and-sign" document. Documentation will be maintained for all individuals completing Radiological Orientation. The following topics will be addressed:

- Radioactive materials that are present at the Site
- NRC Form 3, "Notice to Employees"
- Information regarding radiation safety requirements for work to be performed (e.g., groundwater sampling, well installation, groundwater processing, packaging and shipping for disposal, etc.)
- Site access and egress;
- Response to emergency conditions (including weather, fires, personnel injuries);
- Site industrial safety requirements (including personal protective clothing and equipment, etc.)

2.3.2 General or Site Specific Training

In addition to Radiological Orientation, General or Site Specific Training is required for workers who are permitted unescorted access to Restricted Areas and will include:

- Information regarding the principles and practices of radiation protection;
- Information regarding the purpose and functions of protective and monitoring devices that will be used, as applicable;
- Information regarding protection available for the embryo/fetus, as applicable.

2.3.3 Radiation Worker Training

Radiation Workers are individuals who in the course of employment are likely to receive an occupational dose to radiation greater than 100 mrem (1 milliSievert) in a year or whose duties require them to routinely work in a Restricted Area or routinely handle radioactive material. Such workers may include groundwater processing operators and their supervision.

Radiation Worker training will include:

- General or Site Specific Training described above;
- Radioactivity measurements, monitoring techniques, and usage of monitoring instrumentation;
- Basic calculations involved in using and measuring radioactivity;
- Types of radiation, range and effects;
- Regulatory and site specific dose limits to the general public and occupationally exposed persons;
- Storage, transfer, or use of radiation and/or radioactive material;
- Biological effects of radiation;
- Health protection problems associated with exposure to radiation and/or radioactive material;

- Precautions or procedures to minimize exposure;
- Purposes and functions of protective devices employed;
- Applicable Nuclear Regulatory Commission regulations and license requirements for the protection of personnel from exposure to radiation and/or radioactive material including Radiation Workers requirement to observe regulatory and license requirements to the extent within the workers control;
- Workers' responsibility to report promptly to the licensee any condition which may lead to or cause a violation of Commission regulations and licenses or unnecessary exposure to radiation and/or radioactive material;
- Appropriate response to warnings made in the event of any unusual occurrence or malfunction that may involve exposure to radiation and/or radioactive material;
- Radiation exposure reports which workers may request pursuant to 10 CFR 19.13.

Initial Radiation Worker Training will include a test to verify an adequate understanding of the training. Each test shall have a minimum passing grade of 80%. Each test question answered incorrectly shall be reviewed with the test participant and noted on test. If an individual does not pass the test, the test may be administered a second time. If the candidate fails the test a second time, the candidate must repeat the entire Radiation Worker Training course before he/she can take another test.

A candidate who does not achieve a minimum of 80% on the Radiation Worker test will not be permitted to perform work in a Restricted Area or to handle radioactive material.

2.3.4 Training Delivery

Any of the following techniques, or combination thereof, may be used for radiation safety training:

- Classroom training
- Audiovisual media

- Reading assignments (Self Study)
- Computer-based or on-Line training (Internet)
- On-the-job training (OJT) under the presence of an individual trained in the specific activity being observed;
  - Using survey instrumentation
  - Sample collection
  - Sample analysis, etc.
- Demonstrations
- Drills, and
- Discussions

2.4 Training Frequency

- Initial training shall be conducted before routinely working in a Restricted Area or routinely handling radioactive material;
- Whenever there is a significant change in duties, regulations, or terms of the license; and
- Refresher for radiological orientation and radiological worker training shall be conducted annually (within 12 months).

2.5 Training Records

Training records, including a copy of the initial graded test, for all individuals shall be maintained in accordance with the Quality Assurance Program Plan (QAPP).

3.0 ADMINISTRATION AND RESPONSIBILITIES

3.1 Section Overview

This section describes the radiation protection organization and responsibilities of those individuals implementing the Radiation Protection Plan (RPP).

Administration of the RPP requires coordination among the following individuals:

- Trust Administrator
- Trustee Project Manager
- Radiation Safety Officer (RSO)
- Quality Assurance Coordinator (QAC)
- Project Managers (PMs)
- Activity Leaders
- Individual Workers
- ALARA Committee

3.2 Radiation Protection Organization

The radiation protection organizational structure for the Cimarron Site is shown in Figure 3-1.

Trust Administrator The Trust Administrator is responsible for the management of Trust assets and provides the resources needed to complete the decommissioning of the site. The Trust Administrator monitors and reports the financial status of the Trust accounts. The Trust Administrator is responsible for the preparation of periodic decommissioning funding cost estimates and annual budgets. The Trust Administrator is a permanent member of the site ALARA Committee.

Trustee Project Manager (Trustee PM) The Trustee PM is responsible for overseeing the construction and operation of decommissioning systems, the implementation of radiation and safety, health and safety, quality assurance, and environmental compliance programs. The Trustee PM is responsible for ensuring that all personnel performing decommissioning activities, or working in radiation protection, health and safety, quality

assurance, or environmental compliance functions receive training and have the skills and experience require to perform those functions. In conjunction with the Trust Administrator, the Trustee PM prepares decommissioning cost estimates and annual budgets. The Trustee PM is a permanent member of the ALARA Committee, having expertise in decommissioning and responsibility for implementing decommissioning changes.

Radiation Safety Officer (RSO) – (Jay Maisler) The RSO is responsible for maintenance and implementation of the radiation protection program. The RSO is also responsible for review and revision of the RPP and procedures, radiation exposure monitoring, dose reporting, the radiological instrument program, and all levels of radiation safety training. The RSO is responsible to ensure that all activities comply with license requirements, chair the ALARA Committee, and manage the health physics staff. The RSO is given specific authority to implement and manage the licensee's radiation protection program, either directly or through qualified individuals who are designated in writing as having authority to exercise specific functions. All radiation protection personnel have stop work authority.

The responsibility for the implementation and review of the Material Control and Accountability (MC&A) program is assigned to the RSO for the Cimarron site. The RSO establishes training programs applicable to all individuals that implement activities in accordance with MC&A procedures. The RSO designates specific individuals that will implement activities in accordance with the MC&A Plan.

Quality Assurance Coordinator (QAC) The QAC is responsible for the maintenance and implementation of the quality assurance program. The QAC performs or schedules periodic and/or ad hoc audits and observations of all decommissioning and program management functions. All quality assurance personnel have stop work authority. The QAC is also responsible to perform periodic evaluations of the effectiveness of the quality assurance program and to ensure that all personnel performing quality-critical tasks have received the appropriate level of training on the site-specific quality assurance program. The QAC attends the site ALARA Committee.

Task-Specific Project Managers (PMs) PMs are responsible for the preparation of plans, procurement of services and materials, and the performance of decommissioning projects. PMs ensure that all personnel working on projects have received all the training needed and are qualified to perform the tasks for which they are responsible to perform. PMs are responsible for monitoring the schedule, cost, and quality of the project work.

Activity Leader and Front-Line Supervisor Activity Leaders (ALs) are the front-line supervisors over non-routine work performed at the Cimarron site. ALs are responsible for the preparation of activity plans and procurement of services and materials for non-routine activities. Front-line supervisory personnel are responsible for procurement of services and materials and the performance of decommissioning operations for routine operations. ALs and front-line supervisors ensure that all personnel working on projects are familiar with the activity plan under which the work is being performed, and that they have received all the training needed and are qualified to perform the tasks for which they are responsible to perform. ALs and front-line supervisors are responsible for monitoring the schedule, cost, and quality of the project work.

Individual Worker Each Worker is responsible for complying with regulatory requirements and applicable radiation protection procedures to the best of his/her ability and knowledge.

ALARA Committee The ALARA Committee is responsible for ensuring that ALARA policy and regulatory compliance are integrated into Site work activities as appropriate. The Committee reviews and approves ALARA goals for the Cimarron Site and the effectiveness of the ALARA program in meeting these goals. The Committee also reviews plans for new Site activities to ensure that ALARA principles have been considered, reviews the radiation protection program annually to ensure regulatory compliance and incorporate any necessary changes, and evaluates and approves changes to the Decommissioning Plan or the RPP in accordance with License Condition 27(e).

3.3 Policies

Each individual listed in Section 3.2 has the authority to stop work:

- If radiological health and safety of workers is compromised
- If radiological health and safety of the general public is compromised
- If radiological regulatory non-compliance may occur (includes NRC regulations, license conditions, and radiation protection procedures)

Individuals are encouraged to contact the RSO first if they feel there is a potential regulatory or license violation. This is not a requirement.

Individuals who are not satisfied with the response to an expressed concern have the right to contact the Nuclear Regulatory Commission (NRC) for resolution. See NRC Form 3, "Notice to Employees."

3.4 Radiation Protection Program Document Hierarchy

The order of precedence in regulating the Cimarron Site is:

1. Federal radiation protection regulations (10 CFR)
2. License SNM-928, including the RPP which is incorporated into the license via a license condition
3. Radiation protection program procedures

3.5 Procedure Development

Radiation protection procedures have been developed to provide consistent, effective performance of effluent monitoring, contamination control, and dose rate monitoring. RP procedures include the sampling and analysis of influents and effluents to monitor the accumulation of special nuclear material in resins, the sampling of loaded resin and biomass for waste characterization, and the sampling, analysis, handling, storage, manifesting, transportation, and disposal of low-level radioactive waste.

Radiation protection procedures shall be developed in accordance with the Quality Assurance Program Plan.

Radiation protection procedures shall comply with regulatory requirements, license conditions, and the RPP.

Radiation protection procedures may incorporate or reference applicable technical guidance documents (e.g., U.S. NRC Regulatory Guides and NUREGs, NCRP (National Council on Radiation Protection and Measurements) guidance, ICRP (International Council on Radiation Protection) guidance, ANSI (American National Standards Institute) documents, etc.).

3.6 Procedure, Review, Approval and Control

Radiation protection procedures shall undergo technical verification and review to ensure compliance with regulatory requirements, applicable licenses and permits, and the RPP, as well as conformance, to the extent practicable, with applicable standard practice.

Radiation protection procedure review shall assess compatibility with all other Licensee plans, manuals, and procedures.

Radiation protection procedure review shall ensure that the procedure can be performed as written.

All radiation protection procedures shall be reviewed and approved by the RSO.

All radiation protection procedures shall by reviewed by the QAC or designee for conformance with quality assurance program requirements.

All radiation protection procedures shall be controlled in accordance with regulatory requirements and the Quality Assurance Program Plan.

3.7 Desk Instructions

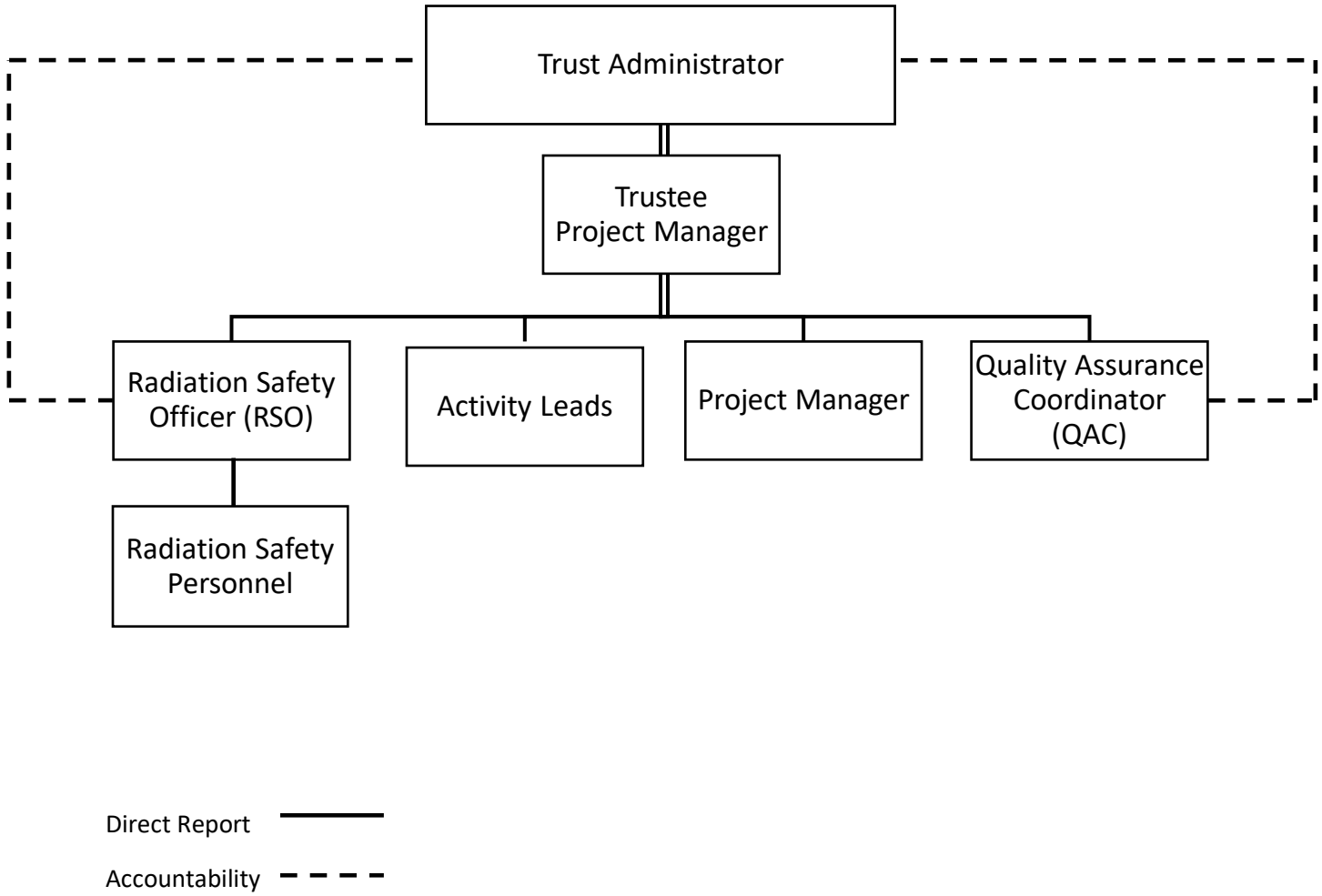
Desk instructions may be developed and implemented to provide a reference guide on specific topics that help the user implement various aspects of the RPP. Desk instructions may be written to address use of specific radiation survey instrumentation or details associated with electronic survey form completion. Desk Instructions are issued by the RSO or designee and expire 12 months after approval. Desk Instructions may be renewed at additional 12 month increments.

3.8 Notifications and Reports

Notifications and reports shall be made in accordance with the requirements of 10 CFR 19, 10 CFR 20 and 10 CFR 70.

Figure 3-1

The Cimarron Environmental Response Trust Organization



4.0 ALARA PROGRAM

4.1 Section Overview

This section describes the philosophy, requirements, and responsibilities of the Cimarron Site As Low As Reasonably Achievable (ALARA) program.

4.2 ALARA Policy

The Cimarron Site radiation protection program uses, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and dose to members of the public that are ALARA. The licensee is committed to providing resources such as personnel, training programs, engineering controls, monitoring devices, activity planning, etc. to achieve the goals of the ALARA principle.

RP-10, "ALARA Program" is the implementing procedure for the ALARA program. In addition, the licensee encourages individuals working at the Site to provide input regarding improvements that would minimize dose and improve the safety and efficiency of activities.

At a minimum, the ALARA Committee meets once each calendar quarter.

4.3 ALARA Committee Responsibilities

The responsibilities of the ALARA Committee include:

- Ensuring that ALARA policy and regulatory compliance are integrated into all Site work activities as appropriate
- Reviewing and approving ALARA goals for the Cimarron Site (if individual monitoring is required)
- Reviewing the effectiveness of the ALARA Program (if individual monitoring is required)
- Reviewing plans for new activities to ensure that ALARA principles have been considered

- Annual review of the RPP to ensure regulatory compliance and to incorporate any necessary changes

- Evaluate and approve changes to the Decommissioning Plan or the RPP in accordance with License Condition 27(e)

4.4 ALARA Committee Membership

As stipulated in License Condition 27(e), which states:

"The ALARA Committee shall consist of a minimum of three individuals, one of whom shall be designated as the ALARA Committee chairman. Of these three designees, one shall have expertise in management and shall have managerial and financial responsibility for the decommissioning of the site; one shall have expertise in decommissioning and shall be responsible for site decommissioning, and one shall be the site Radiation Safety Officer or equivalent, and shall ensure conformance to radiation safety and environmental requirements. The designee with managerial and financial responsibility shall be employed by the licensee's Trustee. The designee for decommissioning of the site and the Radiation Safety Officer or equivalent, shall be retained by the Trustee. Except for the representative of management, ALARA Committee members may be consultants."

In accordance with this License Condition, the ALARA Committee shall consist of a minimum of three individuals:

- The Trust Administrator is a permanent (voting) member who has managerial and financial responsibility for the decommissioning of the Site. The Trustee is stipulated in the Cimarron Environmental Response Trust Agreement dated February 14, 2011.

- The Trustee Project Manager is a permanent (voting) member who is responsible for Site decommissioning and groundwater remediation.

- The Site RSO chairs the ALARA Committee and ensures conformance to radiation safety and environmental requirements. The RSO is a permanent (voting) member of the ALARA Committee.

The licensee is authorized to make certain changes to the NRC-approved Decommissioning Plan (DP) and Radiation Protection Plan (RPP) without NRC's approval, if these changes are consistent with the ALARA principle and the decommissioning process.

These changes are discussed in License Condition 27(e) and require ALARA Committee approval. Formal approval of such changes shall require a majority of the voting members and documented in minutes from the ALARA Committee meeting where these changes were approved.

Additional non-voting members may be included, as appropriate, to address technical issues such as quality assurance, decommissioning activities, health physics, hydrogeology, etc. The QAC routinely attends ALARA Committee meetings to monitor Committee activities and report on QAPP issues. Others may periodically be appointed to the Committee including, Project Managers and Activity Leaders involved with radiological work activities.

4.5 ALARA Committee Meetings

ALARA Committee meetings will include reports on the following aspects of decommissioning work:

- Radiological exposures
- Compliance with license possession limits
- Compliance with Material Control & Accountability requirements
- Active Activity Plans
- Quality control/quality assurance performance issues
- Chemical concerns
- Health and safety performance and issues
- Radiological waste characterization and disposal

5.0 ASSESSMENTS

5.1 Section Overview

Audits and/or surveillances provide a review of decommissioning and radiation protection activities to evaluate compliance with regulatory requirements, license conditions, and the radiation protection plan and procedures. Audits and/or surveillances identify unsatisfactory performance and/or weaknesses in procedures, training, or work practices. The results of all audits and surveillances are reviewed by the ALARA Committee.

5.2 Audits

10 CFR 20.1101(c) requires that a licensee shall, at least annually, review the radiation protection program content and implementation. Various NRC guidance documents (e.g. Appendix L, NUREG-1556, Vol. 7) provide sample forms to assist the licensee in meeting this requirement.

Periodic audits (review of documentation and records), the ALARA Committee review of the RPP and an annual audit modeled on NRC's sample audit form are used to meet this requirement. Periodic audits are conducted, as required, under the Quality Assurance Program Plan. Audits shall be documented, as well as program changes resulting from audit findings or observations.

5.3 Surveillances

Surveillances are observations of activities being performed. Surveillances of Site activities are done by, or under the direction of, the Quality Assurance Coordinator and/or the RSO. The goal of surveillances is to determine whether or not an activity is being performed in accordance with applicable procedures, plans, accepted industry standards, etc. Surveillances shall be documented, as well as program changes resulting from findings or observations made during surveillances.

5.4 Records

Records of audits and surveillances are maintained in accordance with the Quality Assurance Program Plan (QAPP).

6.0 PERSONNEL MONITORING

6.1 Individual Monitoring of Occupational Dose

NRC regulation 10 CFR 20.1502 requires the licensee to monitor occupational exposures from both licensed and unlicensed radiation sources. Monitoring is required of any adult likely to receive, in 1 year from sources external to the body, a dose in excess of 10 percent of the Occupational Dose Limits for Adults and/or who are likely to receive, in 1 year, an intake in excess of 10 percent of the applicable annual limit on intake (ALI) in Table 1, Columns 1 and 2, of Appendix B to 10 CFR 20.1001-20.2402. Monitoring for minors is required when they are likely to receive, in 1 year, from radiation sources external to the body, a deep dose equivalent in excess of 0.1 rem, a lens dose equivalent in excess of 0.15 rem, or a shallow dose equivalent to the skin or the extremities in excess of 0.5 rem and/or likely to receive, in 1 year, a committed effective dose equivalent in excess of 0.1 rem. Monitoring of declared pregnant women is required when they are likely to receive during the entire pregnancy, from radiation sources external to the body, a deep dose equivalent in excess of 0.1 rem and/or likely to receive during the entire pregnancy, a committed effective dose equivalent in excess of 0.1 rem.

Personnel monitoring has not been performed since 2006 because there was no potential to receive a dose that would require monitoring under 10 CFR 20.1502. During the design of groundwater extraction and treatment systems, new work activities, such as groundwater processing, were evaluated to determine if they may result in exposure requiring personnel monitoring. The threshold dose for personnel monitoring will not be approached; accordingly, neither monitoring workers for external or internal occupational dose is required. Area radiation monitoring was established (see Section 10.5 of the RPP) to confirm the results of this evaluation. Air sampling during spent ion exchange resin handling activities will be performed as discussed in Section 6.5, below, and Section 11.1 of the Decommissioning Plan.

6.2 Occupational Dose Limits

NRC Regulation 10 CFR 20.1201 establishes a total effective dose equivalent (TEDE) limit and a total organ dose equivalent (TODE) limit for occupationally exposed adults. The TEDE is the sum of the deep dose equivalent (DDE) from external exposures and the committed effective dose equivalent (CEDE) from internal exposures. The TODE is the sum of the DDE and the committed dose equivalent (CDE) to the organ receiving the highest dose. The following annual dose limits apply to all the licensee employees, contractors, and visitors who receive occupational dose at the Cimarron Site.

Occupational dose is defined as the radiation dose an individual receives in a Restricted Area and other work-related radiation dose the person receives. Occupational dose does

not include medical dose, dose due to background radiation, or dose received while a member of the public.

6.2.1 Occupational Dose Limits for Adults (10 CFR 20.1201) are as follows:

- Whole Body - The more limiting of a TEDE equal to 5 rem or the sum of the deep dose equivalent and committed dose equivalent to any individual organ or tissue, other than the lens of the eye, equal to 50 rem.
- Skin of the whole body or skin of any extremity - A shallow dose equivalent equal to 50 rem.
- Lens of the Eye - A lens dose equivalent equal to 15 rem.

6.2.2 Occupational Dose Limits to Minors (10 CFR 20.1207) are as follows:

- The dose limits for minors shall be 10 percent of the corresponding limit for adults.

6.2.3 Occupational Dose Limits to Embryo/Fetus (10 CFR 20.1208)are as follows:

- The dose to the embryo/fetus of declared pregnant women shall be limited to 500 mrem during the entire time of pregnancy. Substantial variations in dose rate shall be avoided.

6.3 Dose Limits for Individual Members of the Public (10 CFR 20.1301)

The TEDE received by individual members of the public from licensed operations shall not exceed 100 mrem above background in a year in Restricted Areas. In addition, the dose in any Unrestricted Area from external sources shall not exceed 2 mrem above background in any one hour. Members of the public are not subject to individual monitoring, record keeping, and reporting requirements of 10 CFR 20.

6.4 Determination of Prior Occupational Exposure

The occupational dose during the current year shall be determined and an attempt shall be made to obtain records of lifetime dose for all personnel who are likely to receive a dose in excess of 10% of the annual dose limit. The prior dose history shall be documented on Form NRC-4, or equivalent. Forms NRC-4 and NRC-5 and records used in their preparation shall be retained by the licensee until the regulating agency terminates each pertinent license requiring this record and in accordance with the Quality Assurance Program Plan (QAPP).

6.5 Personnel Monitoring for External Radiation

Individual monitoring for external exposure is not expected to be required during groundwater extraction and processing and related activities. Passive area radiation monitoring using thermoluminescent dosimeters (TLDs) or optically stimulated luminescent dosimeters (OSLDs) will be performed to demonstrate that individuals will not exceed the requirements for individual monitoring provided in the RPP. However, individual monitoring devices will be assigned if any of the following conditions are encountered or expected to be encountered:

- Any individual likely to receive, from radiation sources external to the body, a dose in excess of 10 percent of the 10 CFR 20 occupational dose limits in a year.

- Any minor likely to receive, in 1 year, from radiation sources external to the body, a deep dose equivalent in excess of 0.1 rem, a lens dose equivalent in excess of 0.15 rem, or a shallow dose equivalent to the skin or the extremities that exceeds 0.5 rem.

- Any declared pregnant woman likely to receive during the entire pregnancy, from radiation sources external to the body, a deep dose equivalent that exceeds 0.1 rem.

When external exposure is determined by measurement with an external personal monitoring device, the deep dose equivalent must be used in place of the effective dose equivalent, unless the effective dose equivalent is determined by a dosimetry method approved by the NRC. Dosimetry devices shall be processed by a laboratory or vendor maintaining accreditation by the National Voluntary Laboratory Accreditation Program (NVLAP).

As stipulated in the Decommissioning Plan, if personnel dosimetry devices are used at the Site, procedures will be developed to describe the type, range, sensitivity, and accuracy of required of individual-monitoring devices. Procedures will also include a description of the action levels for worker's external exposure, and the technical bases and actions to be taken when they are exceeded.

Because non-uniform external radiation fields are not expected to be encountered at the Site, procedures do not address the use of extremity and whole body monitors in these situations. Additionally, procedures do not require audible-alarm dosimeters and pocket dosimeters due to low external dose rates that will be encountered during groundwater processing. Determining external dose from airborne radioactive material is not required as the only radionuclides encountered will be uranium isotopes. Area dosimeters and job-specific surveys will be conducted to determine the need for supplemental personnel monitoring.

6.6 Internal Exposure Monitoring

Based on anticipated radiological work involving extraction and treatment of groundwater at the Site, a bioassay program is not warranted. If radiological conditions change or evaluation of the final groundwater processing equipment design indicates that an individual worker could be exposed to 2% of the annual limit on intake (ALI) in a year, then bioassay shall be performed. Bioassay shall be performed whenever a calculated intake of 40 Derived Air Concentration (DAC)-hours could have occurred in any one incident based on air sampling data, accident conditions, equipment failure, external contamination, or other conditions. Bioassay sampling shall also be performed whenever it is likely that an individual may have received an intake of 10 milligrams uranium in any one week. Bioassay shall be considered upon termination of all Radiation Workers who may have had intakes of radioactive materials. The need for bioassay sampling shall be determined by the RSO/designee. Determination of internal exposure requirements are listed in 10 CFR 20.1204.

If the need for a bioassay program is identified, RP procedures will be implemented that include requirements for worker intakes are determined:

- Using measurements of quantities of radionuclides excreted from, or retained in the human body.
- By measurements of the concentrations of airborne radioactive materials in the workplace.
- For an adult, a minor, and a declared pregnant woman using any combination of the measurements above, as may be necessary.

If needed, procedures will also describe how worker intakes are converted into committed effective dose equivalent.

6.7 Declared Pregnant Woman (DPW) Exposure Policy

Based on recommendations of the National Council on Radiation Protection and Measurements (NCRP) and on regulatory requirements, controls are established for the protection of the embryo/fetus during a declared female workers pregnancy. These controls shall ensure compliance with regulatory requirements and protect the rights of the female worker.

Declaration of pregnancy is at the discretion of the woman (medical proof is not required). Any woman who does not declare her pregnancy shall be subject to the normal occupational dose limits and shall not be subject to special controls or treatment

with respect to work assignments involving exposure to radiation even if she is pregnant. The Site shall ensure the dose to the embryo/fetus of a declared pregnant woman does not exceed regulatory limits due to occupational dose during the entire pregnancy.

6.8 Summation of Internal and External Dose

Internal and external doses are summed whenever positive doses are measured. Procedures will be used to document the methodology for the summation of internal and external doses to workers and internal dose contribution from maternal intakes to the embryo/fetus of a declared pregnant worker.

6.9 ALARA Dose Goals

As discussed in Section 4.3, ALARA dose goals will be set if individual monitoring is required. Until such time, the annual Administrative Dose Goals for the Site is effectively 100 mrem TEDE. In cases where Administrative Dose Goals are exceeded without prior authorization, the RSO or designee shall investigate to determine the cause and prepare a written report.

6.10 Personnel Exposure Reports

An annual report of the individual radiation dose received shall be sent to each worker who was issued individual dosimetry and/or was subject to the requirements for monitoring as specified in Section 6.1. When requested by an individual, a written exposure report shall be provided to each such individual within 30 days of the request or within 30 days of exposure determination, whichever is later.

Internal and external doses shall be summed whenever positive doses are measured. The dose to the lens of the eye, skin, and extremities are not included in the summation. Intakes through wounds or skin absorption shall be evaluated and, to the extent practical, accounted for in summation of internal and external doses independent of intakes by ingestion or inhalation.

6.11 Dosimetry Records

Records of individual monitoring shall be kept in accordance with 10 CFR 20.2106 and the Trust QAPP. These records shall be updated at least annually for any radiation monitoring data collected. All radiation exposure records shall use the units curie, rem, rad, or multiples thereof and shall clearly and specifically indicate the quantities (e.g., deep dose equivalent) and units (e.g., rem or mrem) of all recorded values.

Records of total effective dose equivalent and total organ dose equivalent for monitored workers shall be maintained.

Records of embryo/fetus dose shall be maintained with those of the mother, including the declaration of pregnancy.

A procedure provides for the preparation, retention, and reporting of records of occupational dose.

7.0 RADIATION PROTECTION INSTRUMENTATION

7.1 Calibration

Calibration of radiation monitoring, counting, and air sampling instruments shall be performed in accordance with the manufacturers' recommendation unless otherwise approved by the RSO. These calibrations shall be consistent with regulatory requirements.

The calibration frequency for portable radiation monitoring instruments and portable air sampling equipment shall be at least every 12 months. Semi-portable (e.g., continuous air monitors) and fixed (e.g., count room/laboratory instrumentation, portal monitors) instrumentation shall be calibrated at least annually.

7.2 Operation and Response Tests

Operation and response tests of radiation monitoring, counting, and air sampling instruments, shall only be performed by personnel trained in the use of the instrument and following approved procedures. Operation and response tests shall be conducted as required by radiation protection procedures. Desk Instructions may be used to provide guidance on certain aspects of operation and response tests.

7.3 Maintenance and Repair

Maintenance and repair of radiation protection instrumentation shall be performed by qualified personnel or an approved vendor. All maintenance and repair shall be documented.

7.4 Quality Control/Quality Assurance

Quality Control (QC) measures for instruments shall be established and maintained to ensure reliability of counting results and sensitivities. Quality Assurance (QA) for laboratory instrumentation shall be proceduralized and consistent, to the extent practicable, with the requirements of USNRC Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment.

7.5 Radiation Protection Instrumentation Inventory

Table 7-1 provides a list of equipment available to perform radiological surveys at the Site. Procedures provide implementing requirements for the program and a series of

desk instructions provide guidance for using specific instruments, including the following information:

- Instrumentation storage, calibration, and maintenance facilities for instruments used in field surveys
- The method used to estimate the MDC or MDA (at the 95 percent confidence level) for each type of radiation to be detected, as appropriate
- Instrument calibration and quality assurance

Table 7-1

Radiation Protection Instrument List

Make	Model	Probe	Description
Ludlum	Model 12	44-9	Handheld analog ratemeter with a GM pancake-type detector
Ludlum	Model 19	N/A	Gamma micro-R meter (0 to 5000 µR/hr)
Ludlum	2360	43-93	Alpha-Beta Ratemeter, Scaler, and Data Logger with a dual phosphor scintillation probe
Ludlum	3030E	43-10-1	Dual channel, scaler-type sample counter with a dual phosphor detector
Ludlum	2221	44-10	Handheld ratemeter and scaler with an analog display for viewing the count rate with a 2" X 2" NaI(Tl) scintillator
Air Sampling Equipment			
Make	**Model**	**Filter Head**	**Description**
RADEco	AVS-28A	2500-42	Portable, low volume, continuous flow air sampler with a 47 mm diameter open face filter head

QC for instruments shall be consistent with the manufacturer's instructions and be consistent with regulatory requirements.

Review and evaluation of instrumentation operability shall be performed on an on-going basis by the RSO or designee.

8.0 ACCESS CONTROL

8.1 Section Overview

This section provides the access control requirements for entry into and exit from Restricted Areas (RAs). Access control is designed to ensure that individuals have appropriate qualifications, training, and authorization for entry. Access control requirements are applicable to personnel, contractors and visitors who enter RAs. Restricted Areas are areas within the Site boundary for which access is controlled for the purpose of protecting individuals against undue risk from exposure to radiation and/or radioactive materials.

Restricted Areas will be established based on the potential for accumulating radioactive material greater than ten times the 10 CFR 20 Appendix C quantities or requiring posting as Radiation Areas, High Radiation Area, Contaminated Area, or Airborne Radioactivity Areas.

8.2 Restricted Area Access Controls

Only properly trained or escorted personnel shall be permitted inside any RA. Personnel who enter RAs may be required to wear dosimetry. RAs include Radioactive Materials Areas, Radiation Areas, High Radiation Areas, Contaminated Areas, and Airborne Radioactivity Areas. RAs can be controlled through the use of guards, barriers, fences, signs, gates, or doors.

RA boundaries shall be defined by the use of postings, barriers, walls, tape, ropes, markings, or locked doors. A log of personnel entry and exit to any Restricted Area at the Site will be maintained by the RSO or designee.

8.3 Posting and Labeling Requirements

Posting of areas within each RA shall be performed in accordance with 10 CFR 20 Subpart J. Containers of radioactive materials shall be labeled in accordance with 10 CFR 20.1903. Exceptions to posting requirements found in 10 CFR 20.1903 and exceptions to labeling requirements found in 10 CFR 20.1904 shall be approved by the RSO or designee.

Signs used for posting radiological areas within an RA shall include the wording provided in Table 8-1 when the associated requirements are expected to be encountered or expected to be encountered:

TABLE 8-1

RADIOLOGICAL POSTING REQUIREMENTS

POSTING WORDING	REQUIREMENT
"CAUTION, RADIATION AREA"	Accessible area in which radiation levels could result in an individual receiving 5 mrem in one hour 30 cm from the radiation source or surface that the radiation penetrates.
"CAUTION, HIGH RADIATION AREA" or "DANGER, HIGH RADIATION AREA"	Accessible area in which radiation levels could result in an individual receiving 100 mrem in one hour 30 cm from the radiation source or surface that the radiation penetrates.
"CAUTION, AIRBORNE RADIOACTIVITY AREA" or "DANGER, AIRBORNE RADIOACTIVITY AREA"	Licensed airborne radioactive materials in a room, enclosure, or area exists in concentrations exceeding the derived air concentrations specified in 10 CFR 20 Appendix B, Table I, or when an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6% of the annual limit on intake or 12 DAC−hours.
"CAUTION, CONTAMINATED AREA"	Accessible area in which contamination levels exceed 1,000 dpm/100 cm^2 beta/gamma contamination or 1000 dpm/100 cm^2 alpha contamination.
"CAUTION, RADIOACTIVE MATERIAL(S)" or "DANGER, RADIOACTIVE MATERIAL(S)"	Areas or rooms in which there is used or stored an amount of licensed radioactive material exceeding 10 times the quantity of such material in 10 CFR 20 Appendix C.

9.0 RADIOLOGICAL WORK CONTROLS

9.1 Section Overview

Radiological work within Restricted Areas is controlled through two mechanisms; site procedures and Activity Plans. Site procedures include quality assurance procedures, radiation protection procedures, sampling and analysis procedures, operations and maintenance procedures, waste management procedures, etc. Site procedures cover routine work or repetitive tasks that may include radiological work. Any necessary radiological controls are included in site procedures.

Activity plans cover specific work activities and include information on the conditions that exist in the work area and radiological and non-radiological safety requirements. To ensure compliance with the RPP and regulatory requirements, Activity Plans involving radiological work must include the information identified in Section 9.2.

Work within posted Radiation Areas, High Radiation Areas, Airborne Radioactivity Areas, and Contaminated Areas, or requiring the use of respiratory protection or protective (i.e., anti-contamination) clothing shall be controlled through the use of an Activity Plan unless specifically authorized by the RSO or designee. Workers entering any Restricted Area shall be sign in daily on the sign-in sheet maintained in the Site Office or at the location of the routine activity.

9.2 Activity Plan Requirements

The Activity Plan job description and job location shall be consistent with the activities or task to be performed. The Activity Plan shall identify potential radiological hazards, methods to address radiological hazards, and protective equipment needed for the work. Activity Plans shall, as a minimum, include:

- A description of the work,
- Anticipated radiological conditions,
- Reference to applicable procedures,
- Radiation safety requirements,
- Required personal protective clothing and equipment,
- Radiological survey and/or monitoring requirements,

- Training requirements,
- Special sampling requirements.

9.2.1 Activity Plan Approval/Closeout

Activity Plan approval and closeout is addressed in the Quality Assurance Program Plan and implementing procedures.

9.3.1 Activity Plan Training

Training and qualifications for individuals working under an Activity Plan are addressed in the Quality Assurance Program Plan. All Radiation Workers operating under an Activity Plan are required to review and comply with the measures required by the Activity Plan.

9.4.1 Record Keeping

The Quality Assurance Coordinator is responsible for maintaining the Activity Plan and all related documents in accordance with QA procedures.

10.0 RADIATION PROTECTION SURVEYS

10.1 General Requirements

Survey information is used to:

- assist in the development of Activity Plans (AP),
- inform individuals of the radiological conditions/hazards in the area,
- evaluate the need for area postings,
- identify needed personnel protective equipment,
- ensure personnel exposures to radiation and radioactive materials are maintained ALARA,
- determine the decommissioning status of material, equipment, and/or environmental media, and
- determine compliance with regulatory and/or license criteria.

Radiation and contamination surveys, air sampling, and sample collection will be performed as appropriate to assess radiological conditions and to establish specific radiological controls for work to be performed. Radiation protection surveys that are required by the license shall be conducted in accordance with specified requirements.

Two types of dose rates measurements may be used. Contact dose rates are used to locate and identify radiation levels detected and are measured within 1 cm (0.5 in) from the surface being surveyed. General area dose rates are used to identify radiation levels detected at approximately 30 cm (1 ft) from the surface being surveyed.

Surveys for removable and direct contamination are performed to detect and/or quantify radioactive contaminants. Removable contamination surveys should be performed when necessary to ensure that radioactive contamination has not inadvertently spread.

U.S. NRC Regulatory Guide 8.25, "Air Sampling in the Workplace" provides an acceptable method for meeting certain survey and dose assessment requirements of 10 CFR 20. Air samples shall be collected whenever the airborne radioactivity levels are expected to exceed 10 percent of the Derived Air Concentration (DAC) as listed in Appendix B, Table 1 "Occupational" of 10 CFR 20.

Breathing zone air sampling shall be performed whenever respiratory protection devices are worn by personnel. If air sample data indicates a measured level greater than 40 DAC-hours in any shift or operation, whichever is shorter in time duration, the Radiation Safety Officer (RSO) or designee shall conduct an investigation and take corrective actions to reduce airborne contamination levels.

Air sample collection media shall be appropriate to address the radionuclide mixture(s) present. The analysis of air samples (including preliminary field screening) shall be performed in a timely and expeditious manner.

10.2 Routine Surveys

Routine radiological monitoring is performed to ensure that surveys are performed at a frequency that is consistent with the existing and potential hazards and activities planned in the Restricted Areas. The following radiation dose rate and contamination survey frequencies ensure area hazards are adequately characterized:

- Weekly, in office space located in areas surrounding or adjacent to Restricted Areas where the potential exists for external radiation exposure or contamination spread.
- Weekly, in routinely occupied Restricted Areas.
- Monthly, or upon entry, if entries are less frequent than monthly, for Radioactive Material Areas.

10.3 Investigative Surveys

Investigative surveys shall be performed as soon as practicable following the discovery or indication of abnormal radiological conditions.

10.4 Personnel Contamination Monitoring

Personnel shall routinely perform contamination monitoring (frisking) prior to exiting Restricted Areas that have the potential for spreading contamination or per SWP/AP requirement. At a minimum, hands and feet shall be frisked when exiting these areas.

10.5 Area Radiation Monitoring

The RSO or designee will determine when and where area radiation monitoring is appropriate. Area radiation monitoring may be performed using either passive devices,

such as dosimeters (e.g., thermoluminescent or optically stimulated luminescent) or real-time radiation monitors. Dosimeters are posted at the Cimarron Site to confirm that no occupational worker is likely to receive 100 mrem DDE in a year.

10.6 Air Monitoring

Air monitoring is required whenever airborne radioactivity levels are expected to exceed 10 percent of the Derived Air Concentration (DAC) as listed in Appendix B, Table 1 "Occupational Values" of 10 CFR 20. Considering the types of work activities described in this Decommissioning Plan, airborne suspension of licensed radioactive material is not anticipated to generate airborne radioactivity approaching 10% of a DAC. However, the Decommissioning Plan requires that General Area (GA) air sampling, using either low or high volume portable air samplers, will be performed throughout the resin unloading and packaging process for at least the first three resin exchanges. Following analysis of the air sample results from each of these resin exchanges, the RSO will determine the need and frequency of additional air sampling. Selection of air samplers is based on the following criteria:

10.6.1 GA air sampling will be accomplished by using portable air samplers, as discussed, above. Sampling heads will be placed within the breathing zone to ensure that the air sample is representative of the air breathed by the individual worker.

10.6.2 GA air samplers typically sample at a rate of approximately 3-25 liters per minute (lpm) for a low volume sampler to 70 cubic feet per minute (cfm) for a high volume sampler. Based on the nature of the low enriched uranium encountered, the detection capability of the air sampling equipment and associated radiological analysis (e.g., sample counting) will be used to determine the total volume of air needed to be collected to ensure that 10% of the DAC. The enrichment of the uranium will be based on either the actual enrichment being collected on the resin or a conservative basis(i.e. 4%). This calculation will be documented in a site procedure or technical basis document. As the actual enrichment of recovered uranium in each area changes (i.e., WA or BA1), the 10% DAC value may be recalculated Minimum collection times will be determined so adequate sensitivities are achieved for a given monitoring period.

10.6.3 The need for air sampling will be prospectively determined based on the final process system design and potential for generation of airborne radioactivity. Due to the chemical and physical nature of the uranium-bearing media (e.g., water and moist ion exchange resin), minimal, if any airborne radioactivity is expected to be generated. Engineering and physical controls incorporated into the process

equipment design will also be considered in determining the need for air monitoring.

10.6.4 The frequency of calibration of the flow meters on the air samplers will be based on manufacturers' recommendations (typically annually).

10.6.5 Action levels will be developed that will include specific action levels (i.e., specific projected or actual airborne radioactive material concentration levels) for assigning respiratory protection, collecting bioassay samples, and stopping work.

10.6.6 Air samples will be counted on-site using existing laboratory bench top scalers (e.g., Ludlum Model 3030 or similar equipment). Minimum detectable activities (MDAs) based on various sample count times will be calculated and used to determine the sample volume needed to detect less than 10% DAC for 4% enriched uranium. This information will be documented and used to determine the minimum sampling time for lapel air samplers.

10.7 Survey Training and Documentation

Surveys shall be performed by personnel who have been trained commensurate with the type of surveys to be performed. Training will address the following, as applicable:

- Appropriate instrumentation to be used,
- Operational and response checks for survey instrumentation,
- Survey methods, recording of data,
- Calculations, data evaluation, and
- Action levels.

Radiation and contamination surveys performed for compliance purposes, or to demonstrate that decommissioning criteria have been met, shall be documented and maintained in accordance with 10 CFR 20, Subpart L and the Quality Assurance Program Plan.

11.0 RADIOACTIVE MATERIALS CONTROL

11.1 Section Overview

This section addresses radioactive material (RAM) controls employed at the Cimarron Site to control the spread of contamination in Restricted Areas, prevent inadvertent release of radioactive material to Unrestricted Areas, protect members of the public and workers, and minimize the amount of radioactive waste generated during decommissioning operations.

This section of the RPP addresses receipt, labeling, storage, shipment, transfer, controls, theft and loss of radioactive materials.

11.2 Material Control and Accountability

The potential for a nuclear criticality event during the proposed decommissioning program at the Cimarron site is extremely unlikely because the concentration and enrichment of uranium in material generated during decommissioning are low. Treatment of groundwater to remove the enriched uranium content will result in a more concentrated form of uranium on the ion-exchange resin. This step of the process has been evaluated by an analysis to demonstrate nuclear criticality safety.

11.2.1 The RSO is responsible for evaluating proposed changes to the groundwater treatment system and/or process to an individual with experience in nuclear criticality safety evaluation. The RSO will review and approve any changes made to the groundwater treatment system and will periodically conduct inspections of the system and operations to confirm that process and administrative controls assure that the license possession limits are not exceeded.

11.2.2 All personnel responsible for the operation of the process systems will receive training on the potential for nuclear criticality and the need to comply with the controls established to maintain nuclear criticality safety during treatment and processing operations. The training will address:

1. Awareness of the significance of exceeding the basic parameters necessary to stay within the Nuclear Criticality Safety analysis which are:

   - Any measurement of an enrichment >7.33% U-235,

   - Any measurement of the U-235 concentration on the resin >8g/kg,

- The need to assure that the U-235 concentration in packaged waste containers is <0.5g U-235/kg,
- The need to assure that the process system inventory does not exceed 1,200 grams of U-235,
- The need to assure that the total site inventory does not exceed 0.5 effective kilograms of U-235, and
- Any change in the storage of containers or process equipment that would result in a height >7 feet.

2. Awareness that all individuals are required to implement an immediate "stop work" response if any of the above controls are violated.

   These necessary controls are addressed in the Material Control and Accountability procedures. If any of these parameters are exceeded, the Nuclear Criticality Safety analysis has been invalidated and it would be necessary to stop processing operations until either the analysis is redone and/or the situation corrected that led to the exceedance.

11.3 Receipt, Labeling, and Storage of RAM

All radioactive materials shall be received in accordance with radioactive material license possession limits and 10 CFR 70.19. The individual responsible for radioactive material receipt shall perform all surveys as required by 10 CFR 20.1906 and review shipment paperwork to ensure compliance with 49 CFR.

Each container of radioactive material shall be labeled as required by 10 CFR 20.1904.

Radioactive material shall be secured against unauthorized access or removal. Radioactive material storage areas shall be posted and controlled using appropriate barriers and radiological postings.

11.4 Shipment and Transfer of Radioactive Material

RAM shipments shall comply with NRC (10 CFR) and U.S. Department of Transportation (49 CFR) regulations. Low-level radioactive waste shipments transferred for disposal shall be accompanied by a shipment manifest prepared in accordance with 10 CFR 20.2006. Radioactive material shall only be transferred to authorized individuals in accordance with the appropriate regulations in 10 CFR 20, and 10 CFR 70.

11.5 Controls for Radioactive Sources

The Radiation Safety Officer (RSO) shall approve all requisitions for radioactive sources and ensure that source inventories are performed on a quarterly basis. Radioactive sources shall be tested for leakage and/or contamination upon receipt and on a quarterly basis, except that any licensed sealed source is exempt from leak tests if the source contains less than 0.1 microcuries of plutonium or uranium, 100 microcuries of beta and/or gamma emitting radioactive material or 10 microcuries of other alpha emitting radioactive material. The RSO shall approve locations for storage of radioactive sources. Radioactive source storage areas shall be secured against unauthorized removal or access of licensed radioactive material and posted per 10 CFR 20.1902.

Leak testing and inventory of Exempt Quantity radioactive sources is not required, however, these sources should be stored in a secure area to prevent unauthorized removal or access.

Electroplated sources are not swipe tested for leakage to prevent removal of radioactive material from the electroplating.

11.6 Theft or Loss of Radioactive Material

Any individual who discovers that radioactive material is lost, stolen, or missing shall immediately notify the RSO. The RSO shall evaluate the physical and radiological characteristics of the missing material and the potential hazards to workers and the general public, initiate an investigation to locate the material, and perform a root cause evaluation of the incident. The RSO shall determine the need for notifications to regulatory authorities and make notifications as necessary per 10 CFR 20.2201

12.0 CONTAMINATION CONTROL

12.1 Section Overview

The purpose of contamination control is to prevent and/or minimize the spread of radioactive contamination to individuals, areas, and equipment. Control of radioactive surface contamination prevents or minimizes possible inhalation or ingestion of radioactive material by personnel, skin dose from small particles of radioactivity, and the spread to or build-up of radioactive material in the facility or environment from decommissioning operations. Controls to prevent the spread of contamination shall be proposed by the Activity Leaders and approved by the RSO or designee prior to implementation.

12.2 General

Radioactive contamination of buildings and equipment located within a Restricted Area shall be maintained below the removable contamination limit of 1,000 dpm/100cm^2 alpha. In addition, Contaminated Area controls, including posting, shall be implemented whenever removable contamination in an Unrestricted Area exceeds 1,000 dpm/100cm^2 alpha or 1,000 dpm/100cm^2 beta-gamma. The Site incorporates the ALARA philosophy when selecting decontamination methods and practices.

As a general rule, decontamination is performed by working from areas of low contamination to areas of high contamination if possible. Decontamination materials should be limited to the minimum required for the task. All decontamination materials shall be collected, monitored, and properly dispositioned.

12.3 Contaminated Personnel

Decontamination of personnel shall be performed under the guidance of health physics personnel and shall incorporate good health physics practices and ALARA principles. An individual whose skin or personal clothing is found contaminated above background shall not exit a Restricted Area without prior approval of the RSO. Appropriate surveys and monitoring shall be performed to evaluate dose to the individual resulting from contamination.

12.4 Spill of Radioactive Material

A spill of radioactive material requires immediate actions which include:

- Stop the spill
- Warn other personnel

- Isolate the area
- Minimize radiation exposure

Supplementary actions should include the performance of radiological surveys in immediate and adjacent areas, including downwind.

12.5 Contamination Control During Groundwater Processing

Contamination control during groundwater processing involves both process operations and activities necessary to supply groundwater to the processing facility. This section of the RPP is intended to implement contamination control commitments identified in the Decommissioning Plan.

12.5.1. Soil in certain areas of the site may be disturbed to install injection and extraction trenches, install monitoring wells, etc. These soils have been previously released from license controls. Surveys shall be performed during these activities to determine if soil contamination is encountered. Survey requirements will be consistent with RP procedures and limits specified in associated Activity Plans to ensure compliance with license conditions.

12.5.2. Concentrations of low-enriched uranium will be processed through ion exchange resins that will concentrate the uranium in resins. The concentration of uranium on these resins provides a source of potential contamination. The following contamination control considerations are addressed to ensure that contamination is contained and not spread throughout the processing facilities or across the site.

12.5.3. Influent piping contains low concentrations of uranium with little potential for generating contamination. Routine monitoring is performed during operations to ensure that contamination is controlled and not being spread at well heads where the groundwater is extracted. Connections to the water treatment systems are inspected and monitored to identify and repair leaks.

12.5.4. Engineering controls are included in the design of the groundwater treatment system. Double walled tanks are used to hold the influent groundwater awaiting processing. Ion exchange resins are contained in stainless steel vessels. Spent resins are processed through a wet process that ensures airborne radioactivity is not generated. The spent resin is processed in an enclosed system to contain contamination. Spent resin is packaged as discussed in the Decommissioning Plan. Procedures for contamination monitoring and air sampling are provided to demonstrate the effectiveness of these engineering controls. Protective clothing

shall be prescribed for maintenance activities involving potential exposure to spent resins.

12.5.5. Effluent from treatment systems must contain uranium at concentrations below drinking water standards, as demonstrated by discharge sampling requirements specified in the discharge permit issued by DEQ. Leaks or unintentional releases of effluent do not constitute contamination control concerns.

13.0 UNCONDITIONAL RELEASE OF MATERIALS

13.1 Section Overview

Site personnel are authorized to unconditionally release tools, equipment, parts, and materials provided that radiation levels and surface contamination levels do not exceed the limits in condition 27(c) of the license. Such surveys will be performed and documented by qualified individuals.

13.2 Survey Instrumentation

Instruments used to perform release surveys must be calibrated using National Institute of Science and Technology (NIST) traceable, or equivalent, standards for energies and geometries similar to material being released. The energy dependence of the instruments to alpha, beta, and gamma radiation, as applicable, shall be known and documented.

13.3 Release Surveys of Materials

As provided in license condition 27(c), the Site uses the unrestricted release criteria listed in the August 1987 "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source or Special Nuclear Material" for surfaces of buildings and equipment, and the October 23, 1981, BTP "Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations," for soils or soil-like material. The specific values are listed in paragraphs 13.3.1, 13.3.2, and 13.3.3.

Release surveys will consist of direct (fixed+removable and removable (smears) contamination monitoring. The Site is authorized to release materials provided that the direct and removable levels do not exceed the limits stated in the Trust license and summarized below. Such surveys will be performed and documented by qualified individuals.

Survey plans may be developed for the release of property or equipment associated with non-routine activities. Such surveys plans will include the methods used to estimate uncertainty bounds for each type of instrument measurement.

13.3.1 Surfaces of buildings, equipment, and outdoor areas:

- 5,000 dpm alpha/100 cm^2 averaged over 1 m^2 (direct)
- 5,000 dpm beta-gamma/100 cm^2 averaged over 1 m^2 (direct)

- 15,000 dpm alpha/100 cm^2 maximum over 1 m^2 (direct)
- 15,000 dpm beta-gamma/100 cm^2 maximum over 1 m^2 (direct)
- 1,000 dpm alpha/100 cm^2 averaged over 1 m^2 (removable)
- 1,000 dpm beta-gamma/100 cm^2 averaged over 1 m^2 (removable)

13.3.2 Soils

- Natural Uranium - 10 pCi/g total uranium
- Enriched Uranium – 30 pCi/g total uranium
- Depleted Uranium – 35 pCi/g total uranium
- Natural Thorium – 10 pCi/g total thorium

13.3.3 Exposure Rates

a. Surface of buildings and equipment

- 5 µR/hr – above background at 1 meter

b. Soils

- 10 µR/hr – average above background at 1 meter
- 20 µR/hr – maximum above background at 1 meter

14.0 RESPIRATORY PROTECTION

14.1 Section Overview

Respiratory protection measures shall be employed when necessary to protect workers from airborne hazards. Groundwater treatment results in the generation of moist treatment media with little potential to generate airborne radioactivity. However, as future conditions change and the RSO or designee determines, through review of field conditions or anticipated work functions, that respiratory protection is required, procedures and controls will be instituted in accordance with the requirements found in 10 CFR 20, Subpart H, "Respiratory Protection and Controls to Restrict Internal Exposure in Restricted Areas" for radiological hazards and the Code of Federal Regulations Title 29 Part 1910.134 for non-radiological hazards. Section 14.2 provides specific requirements for the respiratory protection program, if needed.

14.2 Respiratory Protection Program

Respiratory protection will be required if work activities could potentially expose workers to 40 or more derived air concentration (DAC)-hours in a week. Respiratory protection will also be required for any areas where airborne radioactive material concentrations are expected to exceed 1 DAC. If either of these trigger levels are encountered, a respiratory protection procedure or procedures) will be established to include:

- Process controls, engineering controls or procedures to control concentrations of radioactive material in air.
- Evaluations performed when it is not practical to apply engineering controls or procedures.
- Considerations used to demonstrate respiratory protection equipment is required.
- Required medical screening and respirator fit testing.
- Use, maintenance, and storage of respiratory protection devices.
- Respiratory protection training program.
- Selection of respiratory protection equipment.

15.0 ENVIRONMENTAL MONITORING

15.1 Section Overview

Environmental monitoring shall be performed at various locations to monitor the migration of licensed material from former (now decommissioned) sources through environmental media. Final surveys have demonstrated that buildings and soils have been decommissioned. Licensed material exceeds decommissioning criteria in groundwater in three areas: Burial Area #1, the Western Upland Area, and the Western Alluvial Area. The Licensee shall maintain an environmental monitoring program in these three areas until superseded by a groundwater remediation work plan.

Effluent from the groundwater treatment process will be monitored to demonstrate that the concentrations of uranium complies with discharge permit limits and underground injection permits. Monitoring will be performed in accordance with permit requirements and the Sampling and Analysis Plan.

15.2 Surface and Groundwater Monitoring

Surface and groundwater samples are collected annually and are analyzed for fluoride, nitrates/nitrites, and U-235 and U-238 mass concentration. The locations identified in Table 15-1 shall be sampled on an annual basis.

Upon approval of Decommissioning Plan, the in-process groundwater monitoring plan described in Section 8.6 of the Decommissioning Plan will replace the environmental monitoring program described in the preceding paragraph.

15.3 Quality Control in Sampling

Sample collection, preservation, shipping, and analysis shall be conducted in accordance with the site-specific Sampling and Analysis Plan and associated procedures. Data review, reporting, and management will be conducted in accordance with Quality Assurance Implementing Procedure, QAIP-17.1, "Data Management Procedure."

15.4 Reporting

Environmental monitoring results shall be reported to NRC within 30 days of the completion of data review.

TABLE 15-1

SURFACE AND GROUNDWATER MONITORING LOCATIONS

BURIAL AREA #1	**WESTERN UPLAND AREA**
1314	1351
TMW-08	1352
TMW-09	1354
TMW-13	1356
02W06	
02W08	
02W09	**WESTERN ALLUVIAL AREA**
02W16	MWWA03
02W17	MWWA09
02W27	T-62
02W28	T-64
02W32	T-70R
02W35	T-76
02W42	T-77
02W43	T-79
02W44	T-82
SURFACE WATER	
1201 Cimarron River Upstream	
1202 Cimarron River Downstream	

16.0 DEFINITIONS

Absorbed Dose: Energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the rad and the gray (Gy). 1 Gy = 100 rad

Administrative Changes: Administrative changes to documents are defined as editorial corrections (e.g., grammatical, typographical, etc.) or other administrative changes such as personnel title changes, changes in procedure names, or other changes that do not alter the technical or procedural content of a document.

Administrative Dose Limit: A radiation dose limit established by licensee for the purpose of maintaining radiation dose below regulatory limits.

Adult: An individual 18 or more years of age.

Airborne Radioactive Material or Airborne Radioactivity: Radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors, or gases.

Airborne Radioactivity Area: A room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of licensed material, exists in concentrations:

(1) in excess of the derived air concentrations (DAC) specified in appendix B of 10 CFR 20.1001 – 20.2401, or

(2) to such a degree that an individual present in the area without respiratory protection equipment could exceed, during the hours an individual is present in a week, an intake of 0.6% of the Annual Limit on Intake (ALI) or 12 DAC hours.

ALARA: An acronym for "As Low As is Reasonably Achievable". ALARA means making every reasonable effort to maintain exposures to radiation as far below the dose limits in 10 CFR 20 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 state of technology, the economics of improvements in relation to benefits to the 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.

ALARA Committee: The Cimarron Site ALARA Committee that has responsibility for overall coordination of the ALARA Program. The Committee is composed of members as described in Section 4.0 of this RPP and meets on a regular basis (typically, quarterly) to review the status of the ALARA Program and to approve changes to the Radiation Protection Plan and Decommissioning Plan.

Alpha Particle: A positively charged particle ejected spontaneously from the nuclei of some radioactive elements. It is identical to a helium nucleus that has a mass number of 4 and an electrostatic charge of +2, i.e. two protons and two neutrons.

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 the reference man that would result in a committed effective dose equivalent of 5 rems (0.05 Sv) or a committed dose equivalent of 50 rems (0.5 Sv) to any individual organ or tissue. (ALI values for intake by ingestion and by inhalation of selected radionuclides are given in Table 1, Columns 1 and 2, of appendix B to 10 CFR 20.1001 thru 20.2401).

Audit: An audit is an evidence gathering process. Audit evidence is used to evaluate how well audit criteria (procedures, requirements, policies) are being met. Audit evidence is used to determine how well policies are being implemented, how well procedures are being applied, and how well requirements are being met.

Atomic Number (Symbol Z): The number of protons in the nucleus of an atom.

Background: Ambient signal response recorded by measurement instruments that is independent of radioactivity contributed by the radionuclide being measured in the person or sample.

Background Radiation: Radiation from cosmic sources; naturally occurring radioactive material, including radon (except as a decay product of source or special nuclear material); and global fallout as it exists in the environment from the testing of nuclear explosive devices or from past nuclear accidents such as Chernobyl that contribute to background radiation and are not under the control of the licensee. "*Background radiation*" does not include radiation from source, byproduct, or special nuclear materials regulated by the NRC.

Becquerel (Bq): The term used to describe one disintegration per second (dps).

Beta Particle: Beta particles are emitted by the nucleus of an atom to attain stability. Beta particles are usually negatively charged, and are emitted from the nucleus of atoms with an excess of neutrons and serve to reduce the number of neutrons in the nucleus. Some beta particles are positively charged. These positively charged beta particles, known as positrons, are emitted from a nucleus and result in an increase in the number of neutrons in the nucleus. Negatively charged beta particles and positively charged positrons have a mass equal to 1/1837 that of a proton. Beta particles are easily stopped by a thin sheet of metal or plastic.

Bioassay (radiobioassay): The determination of kinds, quantities or concentrations and, in some cases, the locations of radioactive material in the human body, whether by direct measurement (in vivo counting) or by analysis and evaluation of materials excreted or removed from the human body.

Breathing Zone: The breathing zone is that region adjacent to a worker's mouth and nostrils from which air is drawn into the lungs while he/she is performing assigned work.

Breathing Zone Air Sample: Air which is drawn through or into the sample media and is a fair representation of the workers "Breathing Zone."

Byproduct material:

(1) Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident to the process of producing or using special nuclear material;

(2) The tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by these solution extraction operations do not constitute "byproduct material" within this definition;

(3) (i) Any discrete source of radium-226 that is produced, extracted, or converted after extraction, before, on, or after August 8, 2005, for use for a commercial, medical, or research activity; or

(ii) Any material that—

(A) Has been made radioactive by use of a particle accelerator; and

(B) Is produced, extracted, or converted after extraction, before, on, or after August 8, 2005, for use for a commercial, medical, or research activity; and

(4) Any discrete source of naturally occurring radioactive material, other than source material, that—

(i) The Nuclear Regulatory Commission, in consultation with the Administrator of the Environmental Protection Agency, the Secretary of Energy, the Secretary of Homeland Security, and the head of any other appropriate Federal agency, determines would pose a threat similar to the threat posed by a

discrete source of radium-226 to the public health and safety or the common defense and security; and

(ii) Before, on, or after August 8, 2005, is extracted or converted after extraction for use in a commercial, medical, or research activity.

Calendar Quarter(s): First quarter - January 1 through March 31

Second quarter - April 1 through June 30

Third quarter - July 1 through September 30

Fourth quarter - October 1 through December 31

Calendar Year: From January 1 through December 31.

Calibrate: To adjust and/or determine:

(1) The response or reading of an instrument relative to a series of conventionally true values; or

(2) The strength of a radiation source relative to a standard or conventionally true value.

Committed Dose Equivalent (CDE) ($H_{T, 50}$): Means the dose equivalent to organs or tissues of reference (T) that will be received from intake of radioactive material by an individual during the 50 year period following the intake.

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 ($H_{E, 50} = \Sigma_T W_{T, 50}$).

Contact Dose Rate: A radiation dose rate as measured with the detector or instrument case within 1/2 inch of the surface being measured.

Contamination, Radioactive: Deposition of radioactive material in any place where it is not desired. Radioactive contamination may be removable (loose) or fixed.

Contaminated Area: Any area that has radioactive contamination at levels greater than the radioactivity release limits for unrestricted use.

Continuous Air Sampling/Monitoring: A method of sampling used to measure airborne radioactivity levels in routinely occupied areas.

Controlled Area: An area outside of a Restricted Area but inside the site boundary, where access can be limited by the Licensee for any reason.

Corrective Action(s): Action(s) taken to improve areas of performance or to eliminate causes of adverse trends in performance identified during Audits, Surveillances, and as a response to a Non Conformance Report.

Counts Per Minute (cpm): The rate of ionizing event occurrence in one minute recorded by a radiation detection instrument designed to count ionizing events caused by radiation.

Curie (Ci): A measure of the amount of radioactive material present.

One curie equals 37 billion (3.7 E+10 or 3.7 x 10^{10}) becquerels (dps)or 2.2 trillion (2.2 E+12) radioactive disintegration's per minute (dpm).

A millicurie (mCi) is 2.2 billion (2.2 E+09) dpm

A microcurie (µCi) is 2.2 million (2.2 E+06) dpm

A nanocurie (nCi) is 2.2 thousand (2.2 E+03) dpm

A picocurie (pCi) is 2.2 dpm.

Declared Pregnant Woman (DPW): A woman who has voluntarily informed the licensee, in writing, of her pregnancy and the estimated date of conception. The declaration remains in effect until the declared pregnant woman withdraws the declaration in writing or is no longer pregnant.

Decontamination: Means the process of removing or reducing the level of contamination on an item or individual.

Deep Dose Equivalent (H_d): The dose equivalent at a tissue depth of 1 cm (1000 mg/cm^2) Applies to external whole body exposure.

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 under conditions of light work (inhalation rate 1.2 cubic meters of air per hour), results in an intake of one ALI. DAC values are given in Table 1, Column 3, of appendix B to 10 CFR 20.1001-2401.

Derived Air Concentration-hour (DAC-hour): 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. A licensee may take 2,000 DAC-hours to represent one ALI, equivalent to a committed effective dose equivalent of 5 rems (0.05 Sv).

Detector: That portion of an instrument system sensitive to and used for the quantification of ionizing radiation.

Direct Contamination Survey: This method measures fixed and removable levels of surface contamination. A direct frisk is performed by scanning the survey location using a count rate meter.

Direct Reading Dosimeter (DRD): A monitoring device consisting of a collection chamber coupled with an optical lens and calibrated scale. DRD's can be used as a device to provide individuals with an immediate estimate of their external gamma radiation exposure.

Discrete Source: A radionuclide that has been processed so that its concentration within a material has been purposely increased for use for commercial, medical, or research activities.

Disintegrations Per Minute (dpm): Refers to the number of nuclear transformations occurring per minute.

Disintegrations Per Second (dps): Refers to the number of nuclear transformations occurring per second.

Dose or Radiation Dose: A generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent, as applicable to context and as defined in 10 CFR 20. The unit for absorbed dose is the rad. 100 rad = 1 Gy

Dose Equivalent (H_T): Means the product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units for dose equivalent rem. 100 rem = 1 Sv

Dose Rate: The quantity of absorbed dose delivered per unit of time.

Dosimeter: Any of several types of devices used to measure radiation dose. Common types include TLD, OSL, film, and direct reading dosimeters.

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

Effluent: Material discharged into the environment from licensed operations.

Embryo/Fetus: The developing human organism from conception until the time of birth.

Exposure: Means being exposed to ionizing radiation or to radioactive material. The unit of exposure is the roentgen.

External Dose: That portion of the dose equivalent received from a source of radiation outside the body.

Extremity: Means hand, elbow, arm below the elbow, foot, knee, or leg below the knee.

Fission: The splitting of a nucleus into at least two other nuclei and the release of a relatively large amount of energy. Two or three neutrons are usually released during this type of transformation.

Frisk: The performance of a direct survey for radioactive contamination.

Gamma Ray (Gamma Radiation): High-energy, short wavelength electromagnetic radiation (a packet of energy) emitted from the nucleus. Gamma radiation frequently accompanies alpha and beta emissions and always accompanies fission. Gamma rays are very penetrating and are best stopped or shielded against by dense materials, such as lead or uranium. Gamma rays are similar to x-rays, but are usually more energetic.

General Area Dose Rate: A radiation dose rate measured at 30 cm or more from a surface.

Gray (Gy): The SI unit for absorbed dose: 1 Gy = 1 Joule kg^{-1} = 100 rad. .

Groundwater: Water contained in pores or fractures in either the unsaturated or saturated zones below ground level.

Half-Life, Radioactive: The time required for a radioactive substance to lose 50% of its activity by decay. Each radionuclide has a unique half-life.

In-Vitro Bioassay (indirect): The estimation of radioactivity in the human body based upon:

(1) the measurement of radioactivity in excreta or other materials taken from the body, and

(2) a biological model for the radionuclide movement in body tissues and organs.

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

Individual Monitoring: The assessment of dose equivalent by use of devices designed to be worn by an individual; the assessment of committed effective dose equivalent by bioassay or by determination of the time-weighted air concentrations to which an individual has been exposed; or the assessment of dose equivalent by the use of survey data..

Individual Monitoring Devices: Devices designed to be worn by a single individual for the assessment of dose equivalent. Examples include thermoluminescence dosimeters (TLD's), optically stimulated luminescent (OSL) dosimeters, direct reading dosimeters, and lapel air samplers.

Instrument: A complete system designed to quantify one or more characteristics of ionizing radiation or radioactive material.

Intake: The amount of radioactive material taken into the body by inhalation, absorption through the skin, injection, ingestion, or through wounds.

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

Isotopes: Nuclides having the same number of protons in their nuclei, but differing in the number of neutrons. Isotopes have the same atomic number and different mass numbers.

Lens Dose Equivalent (LDE): Dose equivalent due to external exposure to the lens of the eye. It is taken as the dose equivalent at a tissue depth of 0.3 cm (300 mg/cm^2).

Licensed Radioactive Material: Source material, special nuclear material, or byproduct material received, possessed, used, transferred or disposed of under a general or specific license issued by the NRC.

License: Means the radioactive materials license issued by the NRC to the Trust to possess and/or use radioactive materials. Other licenses may be issued to the Trust by other state or federal agencies.

Licensee: The holder of the radioactive materials license (the Trust).

Limits (dose limits): The permissible upper bounds of radiation doses.

Low-Level Radioactive Waste (LLRW): Those low-level radioactive wastes containing source, special nuclear, or by-product material that are acceptable for disposal in a land disposal facility. Low-level waste has the same meaning as in the Low-Level Waste Policy Act: that is, radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or by-product material as defined in paragraphs (2), (3), and (4) of the definition of *Byproduct material* set forth in 10 CFR 20.1003.

Member of the Public: An individual who is not receiving an occupational dose.

Micro: A prefix meaning "one millionth" (1 E-06), as in microcurie.

Milli: A prefix meaning "one thousandth" (1 E-03), as in millirem, millirad, or millicurie.

Minimum Detectable Activity: The smallest concentration of radioactivity in a sample that can be detected with a 5% probability of erroneously detecting radioactivity, when in fact none may be present (Type I error) and also, a 5% probability of not detecting radioactivity, when in fact it is present (Type II error). Often used interchangeably with Minimum Detectable Concentration, since the difference between the two terms is only one of units conversion.

Minor: An individual less than 18 years of age.

Monitoring (Radiation Monitoring): The measurement of radiation levels, concentrations, surface area concentrations, or quantities of radioactive material, and the use of the results of these measurements to evaluate potential exposures and doses.

Nano: A prefix meaning "one billionth" (1 E-09), as in nanocurie.

NRC: U.S. Nuclear Regulatory Commission or its duly appointed representatives.

Nuclide: Any one of the approximately 1800 isotopes of all the elements, whether radioactive or not. See radionuclide and isotope.

Occupational Dose: The dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation or to radioactive material 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 material and released under 10 CFR 35.75, from voluntary participation in medical research programs, or as a member of the public.

Occupational Dose Limit: The maximum legally allowable dose to individuals during a specific time period, as defined by 10 CFR 20.

Particulate: Sometimes used to describe alpha and beta radiations, but most often used to mean dust or droplets containing radioactive material.

Pico: A prefix meaning "one trillionth" (1 E-12), as in picocurie.

Planned Special Exposure: An infrequent exposure to radiation, separate from and in addition to the annual dose limits.

Posting: A standardized sign or label which bears the standard trefoil radiation symbol in magenta or purple or black on a yellow background and information concerning a specific radiological hazard.

Protective Clothing: Clothing provided to reduce exposure and prevent the spread of contamination to personnel clothing or the body while performing work with radioactive materials.

Qualification: Certification of the fact that an individual possesses the knowledge, capabilities (e.g., physical) characteristics, or abilities gained through experience, training, or on-the-job training that an individual can perform a required task.

Qualified Escort: An individual that meets the Qualified Escort training requirements set forth in Radiation Protection Procedure RP-14, "Training".

Qualified Individual: An individual who has completed the training and or testing requirements set forth by procedures or regulations, which in turn grants that individual permission to operate specific equipment, instrumentation, or work duties.

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

Radiation (Ionizing Radiation): Alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. Radiation, as used within the context of the Radiation Protection Program does not include non-ionizing radiation such as radio or microwaves and visible, infrared, or ultraviolet light.

Radiation Area: Defined as any accessible area where the dose equivalent to an individual could exceed 5 millirem (.05 mSv) in any one hour at 30 cm from the radiation source or surface that radiation penetrates.

Radiation Safety Officer (RSO): The individual responsible for development and oversight of radiation protection program policies at the Cimarron Site. This individual shall meet the requirements set forth in NUREG-1757, Section 17.2.3.1.

Radiation Worker: An individual who has access to the Restricted Areas to perform work and has completed the training requirements listed in RP-14.

Radioactive Material (49 CFR 173.403): For purposes of transportation, any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in the table in 49 CFR 173.436 or values derived according to the instructions in 49 CFR 173.433.

Radioactive Materials Area: Any area or room which is posted and is used to store or contains for use an amount of licensed material exceeding 10 times the quantity of such material as listed in Appendix C to 10 CFR 20.

Radioactivity: Rate of disintegration (transformation) or decay of radioactive material. The units of activity are the curie (Ci) and the becquerel (Bq). Bq = 1 (dps) disintegration per second; Ci = 3.7×10^{10} dps

Radiologically Controlled Area (RCA): See Restricted Area.

Radiological Occurrence Report (ROR): A report generated to document the facts, record the apparent and/or root cause, track the resolution and aid in trending radiological exposure events.

Radionuclide: Any one of the radioactive nuclides.

Record: A document that provides evidence of the quality of services performed, demonstrates that actions were performed in accordance with radiation protection procedures, or demonstrates conformance of actions to regulatory requirements.

Reference Man: A hypothetical aggregation of human physical and physiological characteristics arrived at by international consensus. These characteristics may be used by researchers and public health workers to standardize results of experiments and to relate biological insult to a common base.

Rem: The special unit for 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 (1 rem = 0.01 sievert).

Removable Contamination Survey: The method used to measure removable contamination. Removable survey techniques are:

(1) Smear Surveys - A smear is obtained by using an absorbent filter disk to wipe with moderate pressure across the area or item to be evaluated. A smear is usually wiped over an area of 100 cm^2.

(2) Wipe Surveys – A wipe is obtained by wiping an absorbent pad or towel over a large area or the entire surface of the item being surveyed.

Respirator: An apparatus used to reduce the individual's intake of airborne radioactive materials

Restricted Area: An area having access controlled by the Licensee for the purpose of protecting individuals against undue risk from exposure to radiation and radioactive materials. Restricted Area does not include areas used as residential quarters, but separate rooms in a residential building may be set apart as a Restricted Area.

Sealed Source: Any by-product material that is encased in a capsule designed to prevent leakage or escape of the by-product material.

Shallow Dose Equivalent (SDE): The dose equivalent at a tissue depth of 0.007cm (7 mg/cm^2), averaged over an area of one square centimeter. It applies to external exposure of the skin of the whole body or of an extremity.

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. 1 Sv = 100 rem.

Site Boundary: The line beyond which the land or property is not owned, leased, or otherwise controlled by the Licensee.

Skin of the Whole Body: The skin of the whole body, exclusive of skin of the extremities.

Smear: A radiation survey technique which is used to determine levels of removable surface contamination. A medium (typically filter paper) is rubbed over a surface

(typically of area 100 cm^2), followed by a quantification of the activity on the medium. Also known as a swipe.

Source Material:

(1) Uranium or thorium or any combination of uranium and thorium in any physical or chemical form; or

(2) Ores that contain, by weight, one-twentieth of 1 percent (0.05 percent), or more, of uranium, thorium, or any combination of uranium and thorium. Source material does not include special nuclear material.

Special Nuclear Material:

(1) Plutonium, uranium-233, uranium enriched in the isotope 233 or in the isotope 235, and any other material that the Commission, pursuant to the provisions of section 51 of the Act, determines to be special nuclear material, but does not include source material; or

(2) Any material artificially enriched by any of the foregoing but does not include source material.

Stochastic Effects: Health effects that occur randomly and for which the probability of the effect occurring, rather than its severity, is assumed to be a linear function of dose without threshold. Hereditary effects and cancer are examples of stochastic effects.

Survey: An evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of radioactive materials or other sources of radiation. When appropriate, such an evaluation includes a physical survey of the location of a source of radiation and measurements or calculations of levels of radiation or concentrations or quantities of radioactive material present.

Thermoluminescent Dosimeter (TLD): An integrating detector where radiation energy is absorbed (trapped) and can be read out later by thermal excitation of the detector.

Total Effective Dose Equivalent (TEDE): The sum of the deep dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

Total Organ Dose Equivalent (TODE): The sum of the deep dose equivalent and the committed dose equivalent to the organ receiving the highest dose.

Unrestricted Area: Any area to which access is not limited or controlled for purposes of protection of individuals from exposure to radiation and radioactive materials.

Uptake: Quantity of a radionuclide taken up by the systematic circulation (e.g., by injection into the blood, by absorption from compartments in the respiratory or gastrointestinal tracts, or by absorption through the skin or through wounds in the skin).

Uranium (Natural, Depleted and Enriched):

Natural Uranium: Uranium found in nature. Natural uranium contains 0.71 weight percent U-235, 99.3 weight percent U-238, and a trace of U-234.

Depleted Uranium: Uranium in which the U-235 isotope represents less than 0.71 weight percent of the mass of the material. Depleted uranium is less radioactive than natural uranium.

Enriched Uranium: Uranium in which the U-235 isotope represents greater than 0.71 weight percent of the mass of the material. The alpha emission rate increases from 1.5 E3 dpm per mg at 0.71 weight percent enrichment to 1.4 E5 dpm per mg at 93% enrichment.

Visitor: An individual who is not an employee or contractor of the Licensee.

Week: Seven consecutive days starting on Sunday.

Weighting Factor (W_T): The proportion of risk of stochastic effects resulting from irradiation of the organ or tissue to the total risk of stochastic effects when the whole body is irradiated uniformly.

Whole Body (WB): Means, for purposes of whole body exposure, the head, trunk (including male gonads), arms above the elbow, or legs above the knee.

Year: The period of time beginning on January 1 and ending on December 31 that is used to determine compliance with the NRC.

X-Ray: Penetrating electromagnetic radiation having a wavelength much shorter than that of visible light. X-rays are usually produced by a excitation of the electron field around certain nuclei. In nuclear reactions, it is customary to refer to photons originating in the electron field of the atom as X-rays.

17.0 REFERENCES

1. 10 CFR 19, "Notices, Instructions and Reports to Workers; Inspection and Investigations"

2. 10 CFR 20, "Standards for Protection Against Radiation"

3. 10 CFR 30, "Rules of General Applicability to Domestic Licensing of By-Product Material"

4. 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste"

5. 10 CFR 70, "Domestic Licensing of Special Nuclear Material"

6. NUREG-1556, Vol. 7, "Consolidated Guidance About Materials Licenses, Program-Specific Guidance About Academic, Research and Development, and Other Licenses of Limited Scope Including Gas Chromatographs and X-Ray Fluorescence Analyzers," Appendix L, "Sample Audit Program"

7. NUREG 1757, "Decommissioning Process for Materials Licensees"

8. NCRP 87-1987, "Use of Bioassay Procedures for Assessment of Internal Radionuclide Deposition"

9. Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment."

10. Regulatory Guide 8.25, "Air Sampling in the Workplace"

11. The Cimarron Environmental Response Trust Special Nuclear Material License (SNM-928)

12. Order Transferring License No. SNM-928 for the Cimarron Site

13. "Cimarron Facility Decommissioning Plan," Rev. 1

14. U.S. NRC, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source or Special Nuclear Material," August 1987

15. U.S. NRC, "Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations," October 1981

16. EPM017-CALC-001, "Dose Rate Near Uranium Treatment Train"

APPENDIX O – CIMARRON DECOMMISSIONING PLAN REVISION 1

Criticality and Uranium Loading Calculations

Groundwater contaminated above release criteria will be extracted from subsurface aquifers, piped to treatment facilities, and treated to remove the contaminants by ion-exchange and/or bio-remediation processes as needed. Effluent water from treatment processes will be either reinjected into the ground or discharged to surface water in accordance with an Oklahoma Pollutant Discharge Elimination System (OPDES) permit. Resulting contaminated waste (spent resin) will be processed, packaged and disposed in accordance with applicable requirements. The resin matrix will consist of a hydrocarbon-based resin (DOWEX 1); it becomes loaded with low-enriched uranium during the groundwater treatment process. Prior to packaging the resin matrix, non-resin material will be mixed with the resin as needed to absorb free liquid to satisfy transportation and waste disposal requirements. Since the waste will contain enriched uranium, consideration has been given to the design and conduct of the processing operations to ensure that an inadvertent nuclear criticality incident is not credible.

Waste processing operations and storage of packaged waste were evaluated in three separate areas, operating on two different criticality safety limits. There are two treatment systems and a separate secure storage facility for packaged waste. The two processing locations, although separated by over ½ mile, will be treated as a combined safe mass unit with a limit of 1,200 grams U-235 and a maximum enrichment of 5% U-235. The secure storage facility for packaged waste will be operated on a "safe concentration limit" basis to assure nuclear criticality safety, in which the packaged waste stored in this building (awaiting shipment for disposal) will not exceed the fissile exempt concentration limit of 1 gram of U-235 per 2,000 grams of non-fissile material. The possession of U-235 for the entire site will be further constrained to a total mass limit of 0.5 effective kilograms of Special Nuclear Material (SNM).

A series of calculations were performed based on the assumption that the administrative controls to maintain the safe mass limit for the processing operations and the concentration limit for packaged waste are not effective. The calculations, assuming a uranium enrichment of 7.33% and utilizing an Upper Safety Limit (USL) of [k_{eff} plus 3 sigma] <0.9, demonstrate that the maximum allowable safe fissile concentration is 8 g U-235/kg Resin. This Appendix describes the basis for these input values, presents the calculations performed, and explains why the maximum allowable safe fissile concentration cannot be attained.

This evaluation concludes that it not conceivable that any combinations of upset conditions could occur that would result in a [k_{eff} plus 3 sigma] exceeding 0.9. Therefore, an inadvertent criticality incident is not credible.

Criticality Calculation Overview

The criticality calculations prepared for the study incorporate the following conservative assumptions:

1) All fissile material on the site is located in one contiguous area even though there are three physically separate locations planned.
2) The enrichment of the uranium is assumed to be 7.33% U-235, even though on average the enrichment is at a maximum of approximately 4.5% U-235 in two areas of the site and about 1.5% in another area.
3) The criticality model is based on an infinite slab model with a thickness of 7 feet.
4) The composition of the fissile material mixture is low-enriched uranium (maximum of 7.33% U-235) adsorbed on a hydrocarbon resin material.
5) No credit is taken for the administrative controls that will be implemented to maintain the safe mass limit and concentration limits specified in the license.

The analysis is based on a highly conservative value of 7.33% enriched uranium and a conservative Upper Safety Limit (USL) of k_{eff} + 3 sigma > 0.9. The analysis establishes an allowable safe fissile concentration of 8 g U-235/kg Resin.

Groundwater Processing Overview

Concentration of fissile material will occur on the ion-exchange resin as the groundwater is treated to remove the uranium. The relationship between the groundwater concentration of uranium and the uranium concentration on the resin is based on tests that were conducted using the selected resin material and using actual groundwater samples from the site.

The maximum enrichment value of 7.33% U-235 was also conservatively established using historic groundwater monitoring data based on analytical measurements over a 16 year period by the alpha spectrometry (HASL-300) method.[1] It was based on the maximum enrichment measured plus 2 sigma

[1]A comparative evaluation of alternate analytical methods concluded that the ICP-MS (EPA 200.8) would be used for project measurements of the U-235 and U-238 mass concentrations for liquid and solids. An evaluation of groundwater measurement data by ICP-MS since December 2016 demonstrated that the maximum enrichment at the 95% confidence level for the site is 4.76%. Since this value is less than the 7.33% value used for the criticality safety evaluation, it was determined that the criticality safety evaluation is conservative, and no change is required. (Reference: Enercon Technical Memo titled "Determination of Maximum Conservative U-235 Enrichment Levels for Groundwater at Cimarron Site Utilizing ICP-MS Data Collected December 2016 Through the 1st Quarter 2018" dated April 12, 2018.)

(95% Upper Confidence Level (UCL)) for the highest single historic measurement of any well that will feed the three treatment trains. Samples where the uranium concentration was less than 30 pCi/L were not included because the uncertainty associated with laboratory analysis of isotope measurement value significantly increases and is not reliable.

During operations, the groundwater feed to each treatment train will consist of a blend of groundwater from a many different extraction wells. An evaluation was made of the historic values of calculated enrichment values for the wells that are located within each of the three areas that will feed the treatment trains. Table 1 presents the results for the average and maximum enrichment at the 95% upper confidence level (UCL) anticipated in each of the three treatment trains. Note that the current design of the Treatment System will combine the feed from Areas 1 and 2 into one storage tank which will result in an averaging of the groundwater concentration and enrichment for Trains 1 and 2. The analysis presented in this Appendix is based on not combining the two areas into one feed stream.

Table 1: Projected Maximum Enrichments During Initial Operations

	Concentration (pCi/L)	Average Enrichment	Average Propagated Uncertainty	Maximum Enrichment at 95% UCL
Train 1	≥30	3.48%	0.71%	4.19%
Train 2	≥30	2.69%	1.14%	3.82%
Combined flow to Trains 1 & 2	≥30	3.09%	0.93%	4.01%
Train 3	≥30	1.51%	0.37%	1.88%

These maximum enrichments are less than the enrichment assumed for the criticality calculations.

Criticality Calculation Methodology and Results

Criticality calculations were performed for the following 3 cases:

- Infinite 7-foot Slab of Homogenous Resin-UO_2 Mixture
    - Enrichment of 7.33 wt% U-235
    - Fissile Concentrations ranging from 1 to 10 g U-235/kg resin
- Infinite 7-foot Slab of Homogenous Resin-UO_2 Mixture for the conditions expected during initial operations.
- Transportation Model from NUREG/CR-4382 (see Appendix I of the NUREG)
    - Enrichment of 7.33 wt.% U-235
    - Fissile Concentration of 0.5 g U-235/kg matrix material

- Matrix Material is modeled as both resin and SiO_2

Table 2 provides the uranium enrichments and fissile concentrations used in the three cases.

Table 2: Enrichments and Fissile Concentrations used for Criticality Safety Evaluations

Cases for Nuclear Criticality Safety Evaluation		Enrichment (% U-235)	Fissile Concentration (g U-235/kg)
Bounding Case		7.33	1 to 10
Operational Cases	Train 1	4.19	2.3
	Train 2	3.82	1.5
	Train 3	1.88	4.2
Transportation Case		7.33	0.5

For the bounding case, the infinite slab is modeled in Monte Carlo N-Particle Transport Code (MCNP) by filling a 7-foot tall rectangular prism with the homogenized resin-UO_2 mixture. The x and y dimensions are 100 cm in width and have reflecting boundary conditions to simulate an infinite slab. There is a 1-foot water reflector modeled in the z dimension. The fissile concentration was varied from 1 to 10 g U-235/kg Resin. The results for these calculations are provided below in Table 3 and Figure 1.

The following additional modeling assumptions are made for the infinite 7-foot slab calculations:

1. The resin is assumed to be composed of carbon and hydrogen with an atomic ratio of 1.
2. The resin is assumed to have a theoretical density of 1.1 g/cm^3 with a 70% packing fraction.
3. The resin is assumed to be dry and there is no additional groundwater present. Previous calculations have shown that the resin-UO_2 mixture is over-moderated and additional groundwater reduces the reactivity.

For the operational cases, the k_{eff} value was calculated for each of the three treatment trains using the maximum expected enrichment (95% UCL) and the maximum expected uranium concentration (95% UCL) on the resin. These calculated values are provided in Table 4 and are shown in Figure 1. At the Upper Safe Limit (USL) of $k_{eff\ plus}$ 3 sigma of 0.9, the interpolated value for the fissile concentration on the resin is 7.978 g U-235/ kg resin. This value has been rounded to 8 g U-235/ kg resin.

As shown above in Table 2, the maximum expected U-235 loading on a resin bed is 4.2 g U-235 per kg of resin. This fissile uranium concentrations on the resin is approximately half of the maximum fissile concentration of 8 g U-235 per kg of resin established as the conservative limit by the bounding case evaluation.

The results for the third case (the transportation evaluation) are presented in Appendix I.

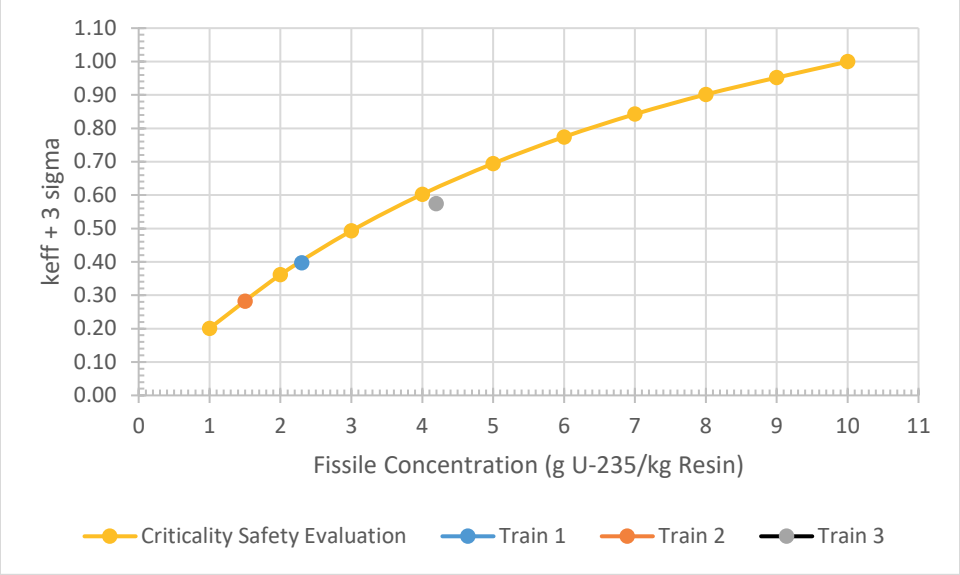
Table 3: k_{eff} Results for an Infinite 7-foot thick Slab of Resin and UO_2 at 7.33 wt% U-235

g U-235/kg Resin	g U/kg Resin	k_{eff}	σ	$k_{eff} + 3\sigma$
1	13.6	0.20069	0.00009	0.20096
2	27.3	0.36111	0.00013	0.36150
3	40.9	0.49222	0.00018	0.49276
4	54.6	0.60176	0.00021	0.60239
5	68.2	0.69380	0.00024	0.69452
6	81.9	0.77332	0.00026	0.77410
7	95.5	0.84140	0.00029	0.84227
8	109.1	0.90034	0.00031	0.90127
9	122.8	0.95089	0.00031	0.95182
10	136.4	0.99842	0.00035	0.99947

Table 4: k_{eff} Results for Resin in Three Trains

Train	Enrichment (wt. % U-235)	Fissile Concentration (g U-235/kg Resin)	k_{eff}	σ	$k_{eff} + 3\sigma$
1	4.19	2.3	0.39689	0.00016	0.39737
2	3.82	1.5	0.28120	0.00012	0.28156
3	1.88	4.2	0.57345	0.00025	0.57420

Figure 1. k_{eff} Results for an Infinite 7' Slab of Resin and UO_2 at 7.33 wt% U-235



Possible Upset Conditions for Groundwater Extraction and Process Operations

The following process upset condition could potentially occur, either individually or in conjunction:

1. Major resin spill
2. Major groundwater spill
3. Equipment rearranged to consolidate all within one building including waste containers from storage location
4. External event such as earthquake or high winds disrupts building integrity and process equipment integrity and location
5. Operational errors during the operation of the process equipment such as misaligned valves

The geometric model for the criticality calculations assumes that the configuration of the fissile unit is a 7-foot thick infinite slab at the maximum concentration allowable on the resin matrix. None of the above events would result in a configuration of fissile material outside the model used in the evaluation.

Possible Upset Conditions for Resin Loading

The normal operational condition is that the groundwater feeds to each treatment train as a combined flow from multiple extraction wells such that the uranium mass concentration and the U-235 enrichment is a composite average of many extraction wells.

To address an upset condition in which all the groundwater comes from a single well location at the highest uranium mass concentration, the well sample data was reviewed, and the highest mass concentration sample was identified. The value is further increased by the 2-sigma uncertainty to obtain the maximum groundwater concentration at the 95% confidence level. The concentration of the uranium on the resin is then calculated using the Upper Bound equation for the loading of the resin. This Upper Bound value is then further increased by adding the 2-sigma value to obtain the maximum uranium concentration on the resin at the 95% confidence level. The U-235 enrichment for this groundwater stream is taken as the maximum enrichment at the 95% confidence level for the well. These calculation results are presented in Table 5 for each of the three areas that feed the three Trains.

Table 5: Resin Loading Calculation Results

Treatment Area and Well	Maximum Influent Uranium Concentration	Maximum Influent Uranium Concentration at 95% UCL (µg/l)	Maximum Uranium Loading on Resin 95% UCL (g/kg)	95% UCL Uranium Enrichment (% U-235)	Maximum U-235 Loading on resin at 95% UCL (g/kg)
Train 1 Well MWWA-03	562	593	55	5.50%	3.0
Train 2 Well T-63	127	139	39	3.40%	1.3
Train 3 Well TMW-13	4,560	4,841	221	1.55%	3.4

This approach is conservative because it adds the 2-sigma uncertainty to each measured and calculated parameter. These U-235 loadings are bounded by the assumption in the criticality calculations in that the U-235 enrichment is 7.33% and the safe resin concentration is 8 g U-235/kg resin.

The results show that for all three treatment trains both the maximum fissile uranium concentration on the resin and the maximum U-235 enrichment are well within the conservative assumptions utilized in the criticality calculations. The postulated upset condition has an extremely low probability of occurring and the extended time frame over which it would have to continue without detection, but regardless the upset condition would not exceed the bounding assumptions utilize in the criticality calculations. Based on this information, it is concluded that no process operations equipment or management measures are required to be identified as items relied on for safety (IROFS).

Conclusions:

The criticality calculations described here demonstrate that the process will remain subcritical for loadings of up to 8 grams U-235 per kg of resin. A review of potential upset conditions indicates that it not considered credible that a combination of upset conditions could occur that would exceed both the U-235 enrichment and the uranium mass loading utilized in the calculations. Therefore, the probability of an inadvertent criticality incident is not credible. The following list summarizes the primary reasons that support the conclusion stated.

1. The enrichment in the groundwater would have to exceed 7.33% U-235 which is significantly higher than that measured on the site.
2. The uranium fissile concentration in the resin would have to exceed the limits calculated. Historical data of uranium concentration from groundwater sampling data and the tests conducted on the resin materials provides the information to show this is not feasible.
3. The infinite slab geometry of the model bounds any possible configuration of SNM on the site.
4. The resins provide a limiting concentration of fissile buildup dependent on the concentration of uranium in the groundwater.
5. The higher enrichment in the groundwater is limited to a different and physically separate area from that where the higher groundwater concentrations of uranium are present. It is not physically possible to introduce these two separate groundwater sources into one treatment system.
6. No specific operations systems or management measures are IROFS.

CERTIFICATION OF FINANCIAL ASSURANCE

Principal: Cimarron Environmental Response Trust
c/o Environmental Properties Management LLC
NRC License SNM-928

Cimarron Environmental Response Trust
100 Highway 74 North
Guthrie, OK 73044

Issued to: U.S. Nuclear Regulatory Commission

I certify that the Cimarron Environmental Response Trust (the Trust), administered by its Trustee, Environmental Properties Management LLC, is currently licensed to possess the following types of unsealed special nuclear material licensed under 10 CFR Part 70 in the following amounts:

Type of Material	Amount of Material
Uranium enriched to ≤ 5.0 wt. percent in U-235	1200 grams of contained U-235
Uranium enriched to > 5.0 wt. percent in U-235	*100 grams of contained U-235
Natural and depleted uranium source material	2000 kilograms of uranium
Thorium source material	6000 kilograms of thorium

*If during the decontamination of the facilities and equipment at the Cimarron Plant, uranium solutions or compounds are generated that have a U-235 isotopic content greater than 5.0 wt. percent, prompt action shall be taken to degrade these materials to below 5.0 wt. percent U-235.

The Trust was established in accordance with a *Plan of Reorganization* and a *Consent Decree and Environmental Settlement Agreement* (Settlement Agreement), executed by (among others) the U.S Nuclear Regulatory Commission and the Oklahoma Department of Environmental Quality on February 14, 2011. An *Environmental Response Trust Agreement (Cimarron)* (the Trust Agreement), executed on the same date, established the Trust and designated Environmental Properties Management LLC as Trustee. The Trust Agreement establishes the responsibility of the Trust and the Trustee.

The Trust was funded in accordance with the Settlement Agreement and distributions from the Trust Accounts for work performed to date has been in accordance with the Settlement Agreement and the Trust Agreement. I certify that as of September 30, 2018, remaining funding (Net Assets) for the Trusts (including the Standby Trust Fund) totals $82,374,944 divided as follows among the following Trust accounts:

Account	Amount
Cimarron Trust Federal Environmental Cost Account	$62,206,905
Cimarron Trust State Environmental Cost Account	$12,431,374
Cimarron Standby Trust Fund	$3,727,544
Cimarron Trust Administrative Account	$4,009,121

These accounts were established for the purpose of decommissioning as prescribed by 10 CFR Part 70.

October 31, 2018

Bill Halliburton, Trust Administrator — Date