Enclosure 1 of ACO 18-0001

DP-2605-0001, Decommissioning Plan for the American Centrifuge Lead Cascade Facility

Information Contained Within
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Export Controlled Information

Reviewing Official: ECI Reviewer #152

Date: 01/04/2018

DP-2605-0001

DECOMMISSIONING PLAN

for the American Centrifuge Lead Cascade Facility in Piketon, Ohio

American Centrifuge Operating, LLC
License Number SNM-7003
Docket Number 70-7003

Revision 1 **January 2018**

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ACRONYMS

ACH	American Centrifuge Holdings, LLC
ACL	Administrative Control Level
ACO	American Centrifuge Operating, LLC
ACP	American Centrifuge Plant
ACR	Area Control Room
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
ASL	Approved Suppliers List
ASME	American Society of Mechanical Engineers
AST	Aboveground storage tanks
BEQ	Baseline Effluent Quantities
bkg	Background
Bq/L	becquerel per liter
BZ	Breathing Zone
CA	Contaminated Areas
CART	Corrective Action Review Team
CATSWeb	Web-based Corrective Actions Tracking System
CN	Condition Notification(s)
CCZ	Contamination Control Zones
Centrus	Centrus Energy Corp.
CF	Calibration Factor
CFR	*Code of Federal Regulations*

cm^2	square centimeters
cpm	Counts Per Minute
CTTF	Centrifuge Training and Test Facility
DAC	Derived Air Concentration
DandD	Decontamination and Decommissioning
DCGL	Derived Concentration Guideline Level
DFP	Decommissioning Funding Plan
DOE	U.S. Department of Energy
dpm	disintegration per minute
DPW	declared pregnant woman
EDE	Effective Dose Equivalents
EDMS	Electronic Document Management System
EPA	U.S. Environmental Protection Agency
EV	evacuation vacuum
FBP	Fluor-BWXT Portsmouth LLC
FNAD	Fixed Nuclear Accident Dosimeters
FNMCP	Fundamental Nuclear Material Control Plan
ft	feet
FSRC	Facility Safety Review Committee
FSRS	Final Radiation Survey Report
g	grams
GCEP	Gas Centrifuge Enrichment Plant
GDP	Gaseous Diffusion Plant

HP	Health Physics
HP-IH	Health Physics – Industrial Hygiene
in.	inch
IFT	Intermodal Freight Transport
IH	Industrial Hygiene
IROFS	Items Relied on for Safety
ISA	Integrated Safety Analysis
kg	kilograms
LBGR	Lower Band of the Gray Region
Lead Cascade	American Centrifuge Lead Cascade Facility
LEC	Liquid Effluent Collection
LLMW	Low Level Mixed Waste
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MBA	Material Balance Area
MDA	minimum detectable activity
MDCR	minimum detectable count rate
MEI	most exposed individual
m^2	square meters
mg	milligram
mi	miles
MIV	Machine Isolation Valves
MM	Modified Mercalli
mrem	millirem

MS	Mass Spectrometer
M&TE	Measuring and Test Equipment
NCS	Nuclear Criticality Safety
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NNSS	Nevada National Security Site
NPDES	National Pollutant Discharge and Elimination System
NRC	U.S. Nuclear Regulatory Commission
NQA	Nuclear Quality Assurance
NVLAP	National Voluntary Laboratory Accreditation Program
PCB	Polychlorinated biphenyls
pCi	picocurie
pCi/L	picocuries per liter
PORTS	Portsmouth Gaseous Diffusion Plant
PPE	personal protective equipment
ppm	parts per million
PV	purge vacuum
QA	Quality Assurance
QAPD	Quality Assurance Program Description
RHW	Recirculating Hot Water
RMA	Radioactive Material Area
RMDC	Records Management Document Control
ROI	region of influence

RP	Radiation Protection
RPM	Radiation Protection Manager
RWP	Radiation Work Permits
SMDA	Scan Minimum Detectable Activity
STP	Sewage Treatment Plant
STR	Site Technical Representative
TEDE	Total Effective Dose Equivalent
TLD	Thermoluminescence Dosimeters
U	uranium
UF_6	uranium hexafluoride
UO_2F_2	uranyl fluoride
UST	underground storage tanks
µCi/ml	microcurie per milliliter
µg	microgram
µR	micro roentgens
WAC	Waste Acceptance Criteria
WCO	Waste Certifying Official
WRS	Wilcoxon Rank Sum
wt.	weight

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TABLES

FIGURES

I. EXECUTIVE SUMMARY

☒ The name and address of the licensee or owner of the site

The United States Enrichment Corporation (USEC) was the government corporation formed in 1992 to privatize the uranium enrichment enterprise in the United States and to operate the Gaseous Diffusion Plants in Piketon, Ohio, and Paducah Kentucky. The U.S. Government sold the company in an initial public offering in 1998, and USEC Inc., a private, investor-owned company was created with USEC as a subsidiary. In 2008, limited liability companies were formed as direct and indirect subsidiaries of USEC Inc. to divide the responsibilities for centrifuge deployment. The American Centrifuge Program at the Piketon, Ohio, site is operated by the American Centrifuge Operating, LLC (ACO). After a financial restructuring in 2014, USEC Inc. was renamed Centrus Energy Corp (Centrus).

ACO, or the Licensee, is the applicant for the American Centrifuge Lead Cascade Facility (Lead Cascade) U.S. Nuclear Regulatory Commission (NRC) Materials License (SNM-7003) to possess and use special nuclear, source, and by-product material. ACO is a wholly-owned indirect subsidiary of Centrus.

Centrus' principal office is located at 6901 Rockledge Drive, Bethesda, MD 20817. Centrus is listed on the New York Stock Exchange Market under the ticker symbol LEU. Private and institutional investors own all outstanding shares of Centrus. The principal officers of Centrus are listed below and are citizens of the United States.

Daniel B. Poneman, President & Chief Executive Officer
Stephen S. Greene, Senior Vice President, Chief Financial Officer, & Treasurer

The NRC issued a favorable Foreign Ownership, Control or Influence determination for Centrus and ACO. The Licensee holds the regulatory licenses, including the NRC licenses, required to construct, operate, and decommission the Lead Cascade and American Centrifuge Plant (ACP) in Piketon, Ohio.

The Lead Cascade facilities covered by this Decommissioning Plan are leased from the U.S. Department of Energy (DOE) under a lease agreement for the former Gas Centrifuge Enrichment Plant (GCEP) facilities at the Portsmouth Gaseous Diffusion Plant (PORTS). This lease agreement (GCEP Lease) was entered into pursuant to the Agreement between the DOE and USEC Inc. dated June 17, 2002 which established a deployment schedule for a new cost effective advanced gas centrifuge plant at PORTS. Two of the milestones on this schedule were submittals of applications for the NRC Materials Licenses (Lead Cascade, SNM-7003 and ACP, SNM-2011). Both milestones were met and both licenses have been approved by the NRC. This Decommissioning Plan relates only to the NRC Materials License (SNM-7003) for the Lead Cascade.

Construction and operation of the prototype Lead Cascade occurred in several steps as various models and configurations of centrifuges were tested, with the most recent being a demonstration cascade of 120 AC100 centrifuges. However, in 2016, after successfully testing the Lead Cascade,

DOE discontinued funding of the Lead Cascade and Centrus announced that the Lead Cascade would be shut down and the NRC Materials License (SNM-7003) for the Lead Cascade terminated. Since the NRC Materials License (SNM-2011) for the ACP is not being fully implemented at this time, classified and/or contaminated equipment must be removed from the facilities in which the Lead Cascade was operating in order to terminate the NRC Materials License (SNM-7003) for the Lead Cascade. Centrus has not yet made a final decision with respect to termination of the NRC Materials License (SNM-2011) for the ACP or the GCEP Lease.

☒ The location and address of the site

The Lead Cascade is located on the DOE reservation, known as PORTS. The reservation is located on approximately 3,708-acres of federally owned land near Piketon, Pike County, Ohio.

The mailing address for the Lead Cascade is:

American Centrifuge Operating, LLC
American Centrifuge Lead Cascade Facility
3930 U.S. Route 23 South
P.O. Box 628
Piketon, Ohio 45661-0628

☒ A brief description of the site and immediate environs

A full description of the site and immediate environs is discussed within Section 1.3 of the License Application.

☒ A summary of the licensed activities that occurred at the site

A full description of the facility and process is discussed within Section 1.1 of the License Application (LA-2605-0001). Additionally, Section 1.2.4 of the License Application describes the authorized uses at the Lead Cascade.

☒ The nature and extent of contamination at the site

The footprint of the Lead Cascade is located within a highly developed industrial DOE reservation which has been subject to extensive environmental characterizations. Chapter 3.0 of the Environmental Report (NR-2605-0002) describes the various resources present on and around the DOE reservation as a baseline for the incremental impacts of the Lead Cascade.

Figure I-1 depicts the portion of the DOE reservation associated with the American Centrifuge Program that is roughly enclosed by the below red circle. Within this circle, a specific set of buildings make up the Lead Cascade buildings/facilities. These are identified in Chapter 1.0 of the License Application. The radiological status of the Lead Cascade buildings/facilities is summarized in Table V.a-1 of this Decommissioning Plan.

Figure I-1 DOE Reservation

☒ The decommissioning objective proposed by the licensee (i.e., restricted or unrestricted use)

The GCEP Lease between the DOE and the United States Enrichment Corporation for the GCEP Appendix 1, Section 4.3, *Return of GCEP Leased Premises, GCEP Leased Facilities, and GCEP Leased Personalty*, Section (c) states in part, "Prior to returning the GCEP Leased Facilities, the Corporation will comply with the following criteria: 1) For radiological contamination, the GCEP Leased Facilities shall be returned in a condition that meets NRC's radiological criteria for unrestricted use in 10 *Code of Federal Regulations* (CFR) 20.1402, as amended." The facilities covered by this Decommissioning Plan fall within the GCEP Leased Facilities as defined in the GCEP Lease. Therefore, based upon this lease condition, at the completion of decontamination and decommissioning of the Lead Cascade, the facilities will be prepared for return to the DOE for unrestricted use per lease requirements.

☒ The DCGLs for the site, the corresponding doses from these DCGLs, and the method that was used to determine the DCGLs

The calculated DCGLw is 50,000 disintegrations per minute (dpm)/100 square centimeters (cm^2). However, the Lead Cascade License requirements are more restrictive and limit total contamination levels for unrestricted release to 5,000 dpm/100 cm^2 alpha. Therefore, the

contamination limit for the final status survey will be 5,000 dpm/100 cm^2. This is consistent with the Lead Cascade License requirements and ALARA guidelines. Based on RESRAD-BUILD (discussed below in Section V.b of this Decommissioning Plan), a Derived Concentration Guideline Level (DCGL) of 50,000 dpm/100 cm^2 meets the 25 mrem criteria. Therefore, the contamination levels for the Final Status Survey will be 5,000 dpm/100 cm^2 to be consistent with Lead Cascade license requirements.

☒ A summary of the ALARA evaluations performed to support the decommissioning

As discussed in the preceding response, the 5,000 dpm/100 cm^2 the Licensee will use as the contamination limit for the Final Status Survey is only one tenth of the 50,000 dpm/100 cm^2 calculated DCGLw. This conservatism meets ALARA considerations required by 10 CFR 20.1402.

With respect to occupational exposure, Chapter 4.0 of the License Application, is the currently approved Radiation Protection (RP) program that ensures occupational radiation exposures and radioactive contamination are kept as low as reasonably achievable (ALARA). This program is implemented through approved operating procedures during operations as well as decommissioning activities.

A review of the current RP program and implementing procedures (including the Radiation Work Permits [RWPs]) was completed and documented within internal memo HPIH-16-053I, *Radiological Review – Lead Cascade Decommissioning*. The review evaluated potential doses from equipment removal, packaging, and transportation of waste containers. This review concluded that Lead Cascade decommissioning activities can be performed ALARA. The decommissioning activities required minor revisions to the established Routine Survey Program and only one new activity within the CTTF was identified which required additional controls.

☒ If the licensee requests license termination under restricted conditions, the restrictions the licensee intends to use to limit doses as required in 10 CFR Part 20.1403 or 20.1404, and a summary of institutional controls and financial assurance

☒ If the licensee requests license termination under restricted conditions or using alternate criteria, a summary of the public participation activities undertaken by the licensee to comply with 10 CFR Part 20.1403(d) or 20.1404(a)(4)

The Licensee is not requesting license termination under restricted conditions.

☒ The proposed initiation and completion dates of decommissioning

The Lead Cascade decommissioning efforts began in the first quarter of 2017. The packaging and shipping activities associated with the classified and/or contaminated waste were completed over a ten-month period which began in March 2017 and the final shipment was completed in December 2017.

Figure VIII.e-1 of this Decommissioning Plan (see Appendix D), depicts the latest proposed schedule associated with the remaining decommissioning efforts at the Lead Cascade. Final license termination is expected during the first half of 2018 following NRC approval.

☒ Any post-remediation activities (such as ground water monitoring) that the licensee proposes to undertake prior to requesting license termination

No post remediation activities are planned. The Lead Cascade Facilities, as that term is defined in the Lease, are being free released.

☒ A statement that the licensee is requesting that its license be amended to incorporate the DP

This Decommissioning Plan follows the guidance provided in NUREG-1757, Volume 1, *Consolidated Decommissioning Guidance,* Appendix D. The information provided reflects the decommissioning activities in sufficient detail to enable a reviewer to make a definitive evaluation that the Lead Cascade has been decommissioned without undue risk to the health and safety of the public and with no significant impact to the environment. Decommissioning activities, with the exception of the final status surveys, will have been completed within the bounds of the License Application before NRC approval of the Decommissioning Plan. It is the Licensee's intention to immediately request termination of the Lead Cascade License upon approval of the Decommissioning Plan and the Final Status Survey Report. The Licensee, therefore, requests that the Lead Cascade License remain in place until license termination.

II. FACILITY OPERATING HISTORY

II.a. LICENSE NUMBER/STATUS/AUTHORIZED ACTIVITIES

☒ The radionuclides and maximum activities of radionuclides authorized and used under the current license

☒ The chemical forms of the radionuclides authorized and used under the current license

The Lead Cascade possession limits are provided within Table 1.2-1 of the License Application. The total amount of licensed material that was received by the Lead Cascade over the course of its operation was approximately 318 kilograms (kg) of uranium hexafluoride (UF_6) at natural assay (approximately 0.711 weight (wt.) percent ^{235}U). The amount of licensed material that was present in the Lead Cascade never exceeded 205 kg of UF_6. [See Appendix C of this Decommissioning Plan for additional information]

Uranium compounds encountered at the Lead Cascade are primarily the highly soluble (Class "D") compounds UF_6 and uranyl fluoride (UO_2F_2). Additionally, there are instrument calibration sources addressed in Section XV.a of this Decommissioning Plan.

☒ A detailed description of how the radionuclides are currently being used at the site

The Lead Cascade process equipment has been removed, packaged, and shipped to the Nevada National Security Site (NNSS). Accordingly, no Lead Cascade licensed material is currently being used at the site. The following paragraph discusses past use of radionuclides at the site.

Table 1.2-2 of the License Application for the Lead Cascade provides the Authorized Uses of NRC-Regulated Materials. Previously, the facility was licensed to enrich uranium up to 10 wt. percent ^{235}U. The cascade operated on recycle where the enriched product stream is recombined with the depleted stream prior to being re-fed to the cascade, essentially at natural or normal assay. Small volume samples of UF_6 (<10 grams [g]) were taken for laboratory analysis. However, on December 23, 2016, Amendment 9 of the NRC Materials License (SNM-7003) authorized the removal of "enrichment of uranium" from Table 1.2-2 of the License Application based upon the fact that the equipment needed to enrich uranium was either de-inventoried of gaseous UF_6 and/or was removed from the operating portions of the Lead Cascade such that conducting any enrichment of UF_6 was not physically possible.

☒ The location(s) of use and storage of the various radionuclides authorized under current licenses

The Lead Cascade process equipment has been removed, packaged, and shipped to the NNSS. Accordingly, no Lead Cascade licensed material is currently being used at the site. The following paragraph discusses past use of radionuclides at the site.

The locations of use and storage of the various authorized radionuclides are described in Section 1.1 of the License Application and provided within Table II.a.-1 within Appendix C of this Decommissioning Plan. During operations, the licensed material was primarily used at the X-3001 Process Building, Train 3 area for centrifuge machine testing. Used centrifuge machines containing small quantities of uranium were transferred to the X-7726 Centrifuge Training and Test Facility (CTTF) for rebuild and transfer back to Train 3 for operation via the X-7727H Transfer Corridor. [See Appendix C of this Decommissioning Plan for additional information]

☒ A scale drawing or map of the building or site and environs showing the current locations of radionuclide use at the site

The Lead Cascade process equipment has been removed, packaged and shipped to the NNSS. Accordingly, no Lead Cascade licensed material is currently being used at the site. The following paragraph discusses past use of radionuclides at the site.

The above Figure I-1 of this Decommissioning Plan provides a picture of the Lead Cascade footprint in relation to the entire DOE reservation. Figure II.a-1 within Appendix C of this Decommissioning Plan describes those areas regulated under Materials License SNM-7003 where possession of licensed material is authorized. In addition, a temporary extension of the Lead Cascade Material Balance Area (MBA) into the X-3002 Process Building was implemented during the decommissioning activities. Specifically, the X-3002 building transfer corridor and a portion

of Train 4 South of the boiler area was used temporarily during the decommissioning shipping campaign for inclement weather conditions to allow for loading of trailers and vehicle transport surveys to be performed. Due to the completion of the shipping campaign, this temporary extension has been removed.

As described in Section 1.1.1.6 of the License Application, two principal support facilities are also depicted on Figure II.a-1, specifically the XT-847 Waste Management Staging Facility and X-710 Technical Services Building. The XT-847 was previously used to accumulate, stage, and prepare radioactive, mixed, hazardous waste and non-hazardous recyclable materials prior to shipment off-site. The X-710 provides analytical laboratory support in chemical and isotopic analysis for the Lead Cascade. The two principal support facilities are affiliated with contracted resources obtained through current reverse work authorizations. It is worthwhile to note that the X-710 building and the XT-847 facility do not contain nuclear material regulated by Materials License SNM-7003. The X-710 is a facility under DOE regulation where samples from Lead Cascade are analyzed. The XT-847 is also under DOE regulation and is utilized for radiological waste processing, including minor quantities of Lead Cascade radiological waste.

☒ A list of amendments to the license since the last license renewal

Table II.a-2 NRC Materials License Number SNM-7003 Amendments

Amendment	Date	Brief Description
Original Issuance	February 24, 2004	TAC Nos. L31979 Safety, L31980 Environmental, and L31981 Safeguards – Materials License SNM-7003 is hereby granted to the United States Enrichment Corporation, Inc. (USEC Inc.) to possess and use source and special nuclear material at the American Centrifuge Lead Cascade at the Portsmouth Gaseous Diffusion Plant site in Piketon, Ohio.
1	December 16, 2004	TAC No. L32311 – Condition #14 of the license has been revised to remove language that ties the expiration of the license to the temporary lease of facilities by the United States Enrichment Corporation from the DOE in Piketon, Ohio.
2	January 19, 2007	TAC No. L32360 – Condition #10 (a), (e), (f), (g), (h), and (i) have been changed to reflect the new dates of the License Application, Decommissioning Funding Plan, Decommissioning Funding Plan's Proprietary Tables, Security Program, Fundamental Nuclear Materials Control Plan, and Quality Assurance Program Description. In addition, Conditions 11, 13, and 15 have been changed to remove the language referring to: (1) operational readiness and management measures verification review; (2) notification of intent to introduce UF_6 into the Lead Cascade; (3) emergency plan implementing procedures; and (4) decommissioning funding mechanism. These activities have been completed and the license conditions are no longer necessary.
3	August 6, 2007	TAC No. L32371 – Condition 10(g) has been changed to reflect the changes to the Security Program revised by the referenced letters.
4	August 27, 2007	TAC No. L32374 – Operational Authorization of Classified Computer Network Security Plans. Condition 10(j) has been added to reflect the parameters outlined in the designated approving authority accreditation letters.
5	October 30, 2008	The amendment extends the expiration date of the license by the amount of time that passed from granting the license on February 24, 2004, until USEC Inc. was authorized to initiate startup by introducing process gas to the facility on August 23, 2006. This time period is 30 months. New expiration date of the Materials License is August 23, 2011.
License Renewal Requested	May 20, 2011	TAC No. L33142 – 5-year license renewal request was submitted for NRC review and approval, which requested an extension in the expiration date to August 23, 2016. NRC chose not to review the renewal request and it is in a "timely renewal". Permanent shut down of the Lead Cascade was announced on March 2, 2016.
6	April 5, 2012	TAC No. L34146 – New Condition #16 added to address changes to licensing basis documents which are not covered under 10 CFR 70.72. The amendment also incorporated changes resulting from the NRC's approval of USEC Inc.'s requests during the last 18-24 months.
7	February 8, 2013	TAC L33027 – This amendment effectuates the direct transfer of Materials License SNM-7003 from USEC Inc. to the wholly owned subsidiary limited liability company ACO and will become effective at 6:00 PM, February 8, 2013.
8	July 29, 2013	TAC No. L34218 – Request for exemption from requirements of Title 10 CFR 95.57(c) related to documenting all classification actions by completing and submitting NRC Form 790 to the NRC.
9	December 23, 2016	CAC No. L34372 – Request to remove authorization to enrich uranium at the Lead Cascade

II.b. LICENSE HISTORY

☒ The radionuclides and maximum activities of radionuclides authorized and used under all previous licenses
☒ The chemical forms of the radionuclides authorized and used under all previous licenses
☒ A detailed description of how the radionuclides were used at the site
☒ The location(s) of use and storage of the various radionuclides authorized under all previous licenses
☒ A scale drawing or map of the site, facilities, and environs showing previous locations of radionuclide use at the site

Prior to the initial issuance of the NRC Materials License (SNM-7003) in February 2004, there were no previous NRC licenses that applied to DOE activities within the Lead Cascade buildings/facilities. However, as discussed below, the processing of uranium previously occurred intermittently within these buildings/facilities under a DOE approved Safety Basis; therefore, potential DOE legacy contaminants were primarily uranium and uranium products. In addition, technetium may have been present as a result of the storage of DOE waste from the GDP as discussed below.

The location of use and storage of radionuclides is described in Section II.c of this Decommissioning Plan.

Figure II.a-1 within Appendix C of this Decommissioning Plan depicts the GCEP Leased Premises currently being leased to the Licensee for the Lead Cascade footprint.

II.c. PREVIOUS DECOMMISSIONING ACTIVITIES

☒ A list or summary of areas at the site that were remediated in the past
☒ A summary of the types, forms, activities, and concentrations of radionuclides that were present in previously remediated areas
☒ The activities that caused the areas to become contaminated

The GCEP site was constructed as an alternative to the gaseous diffusion method for uranium enrichment. Construction on the site began in 1979, with demonstration of centrifuge enrichment capability starting in 1982. The demonstration project continued into 1985 at which point the project was terminated. Much of the original equipment from the GCEP program remained in the GCEP Leased Premises until the American Centrifuge Project was conceived.

During the period from 1985 to 2004, DOE used portions of the Leased Premises for storage of radiological waste, with areas of the X-7725 Recycle/Assembly Building (including the Buffer Storage Area) being utilized as an Ohio Environmental Protection Agency permitted *Resource Conservation and Recovery Act* of 1976, Part B storage facility. In 2004 a Temporary Lease was signed which expanded the GDP Lease to include the facilities needed for the Lead Cascade and funded USEC to remove contaminated equipment/waste from these facilities and clean up residual contamination (i.e., USEC was DOE's contractor for the "GCEP Cleanup Program").

Specifics on this "GCEP Cleanup Program" are provided in Section IV.d. Radiological conditions in the Lead Cascade Facilities before this cleanup are unknown, however, a 1993 environmental audit conducted by DOE to determine their liability for legacy contamination under the GDP Lease, did report contaminated areas and contaminated equipment in some of these structures. The source of this DOE legacy contamination has been evaluated using publicly available documents and interviews with former workers. Results of the evaluation for each specific lead cascade building are documented below:

Evaluation of Activities Specific to Lead Cascade Building X-3001

A review of the historical activities in the X-3001 building was conducted to determine the potential for radiological contamination. Prior to commencing construction at the GCEP site, in 1977, ERDA-1549, *Portsmouth Gaseous Diffusion Plant Expansion Final Environmental Statement*, was performed and documented. A review of this document did not identify any pre-existing radiological burial sites or soil contamination areas on which the X-3001 building was constructed. Additionally, interviews with site personnel present during GCEP construction confirm that no radiological conditions existed prior to the X-3001 building construction.

During the DOE Operational/Radiological Waste Storage period, the X-3001 building, a small portion of the X-3012 building, and the X-7726 facility were the only facilities to contain systems for processing uranium. The X-3001 building is divided into 8 trains (4 trains each in the North and South half of the facility) where centrifuges were to be installed for processing uranium. Utility Bays located in the far North and South ends of the facility contain building support equipment as well as equipment to support uranium processing operations. Figure II.c-1 within Appendix C of this Decommissioning Plan depicts the X-3001 building layout. The Utility Bays encompass both floor level and mezzanine areas. During the GCEP program, installation of uranium processing systems was limited to those needed for initial testing and included feed equipment in Train 8, centrifuges in Trains 3 and 4, and support equipment in the North Utility Bay. Upon shutdown of the program in 1985, 720 centrifuges remained in Train 4 and 656 centrifuges remained in Train 3. Internally contaminated uranium processing equipment also remained in Train 8. Also remaining were piping systems connecting the feed equipment located in Train 8 to Trains 3 and 4. This piping traversed the West wall of the X-3001 building and the North Utility Bay Mezzanine from West to East. There are four Liquid Effluent Collection (LEC) and two Oily Water tanks associated with the X-3001 building. The building shares two additional LEC tanks with the X-3012 building. The tanks provide a means for collecting drainage from areas that could contain substances of potential environmental insult. Tank contents are sampled and verified to determine the appropriate disposal path.

From 1985 to 2004, the facility was used for continued storage of GCEP materials and for storage of radioactive waste generated from the GDP. This material was located in Trains 1, 2, 5, 6, 7, and 8. In preparation for storage of waste in Trains 5 through 8, the DOE filled machine mount locations with concrete. The purpose was to provide a level floor area for the movement of waste and transport equipment. Placement of the concrete in the machine mount locations effectively blocked the floor drains from this area, preventing potential contamination from leakage of waste containers from entering the underground liquid effluent and oil drain tanks. Prior to lease of the X-3001 building to Centrus, DOE removed all stored waste from the facility and completed

remediation of contaminated areas to less than 10 CFR Part 835, Appendix D limits. Internally contaminated GCEP equipment remained in Trains 1 through 4, 6, and 8. Additionally, this Leased Premises is listed in Exhibit G of the GCEP Lease as a Leased Premises where hazardous substances were known to have been stored for one year or more, known to have been released, or disposed of. The identified hazardous substances in Exhibit G for the X-3001 building DOE low level radiological waste and Polychlorinated biphenyls (PCBs)/radiological waste. The Condition Report for the X-3001 building, developed at the time of turnover from DOE to Centrus and signed by both parties, stated that centrifuges, piping and service modules located in Train 4 contain radiological contamination.

Evaluation of Activities Specific to Lead Cascade Building X-3002

From a radiological perspective, the X-3002 building has only been used to store low level mixed waste since its construction. There has been no processing of uranium within the facility. Therefore, potential contaminants are primarily uranium and uranium products, as well as technetium from GDP waste storage.

A review of the historical activities in the X-3002 building was conducted to determine the potential for radiological contamination. Prior to commencing construction at the GCEP site, in 1977, ERDA-1549, *Portsmouth Gaseous Diffusion Plant Expansion Final Environmental Statement*, was performed and documented. The areas specific to this Decommissioning Plan are the corridor within the facility and the portion of Train 4 South of the boilers. A review of this document did not identify any pre-existing radiological burial sites or soil contamination areas on which the X-3002 building was constructed. Additionally, interviews with site personnel present during GCEP construction confirm that no radiological conditions existed prior to the X-3002 building construction.

During the DOE Operational/Radiological Waste Storage period, the X-3002 building was used to store various items, including low level mixed waste. Similar to the layout of the X-3001 building depicted in Figure II.c-1 within Appendix C of this Decommissioning Plan, the X-3002 building is divided into 8 trains (4 trains each in the North and South half of the facility) where centrifuges were to be installed for processing uranium. Utility Bays located in the far North and South ends of the facility contain building support equipment. The Utility Bays encompass both floor level and mezzanine areas. In 2000, boilers were installed. There are four LEC and two Oily Water tanks associated with the X-3002 building. The building shares two additional LEC tanks with the X-3012 building. The tanks provide a means for collecting drainage from areas that could contain substances of potential environmental insult. Tank contents are sampled and verified to determine the appropriate disposal path.

From 1985 to 2004, the building was used for storage of various items from the GDP, including GDP generated radioactive waste. Waste originally stored in the X-3001 building was moved to the X-3002 building in preparation for operation of the Lead Cascade. Train 4 was not used to store any radiological material. In preparation for storage of waste, the DOE filled machine mount locations with concrete. The purpose was to provide a level floor area for the movement of waste and transport equipment. Placement of the concrete in the machine mount locations effectively blocked the floor drains from this area, preventing potential contamination from leakage of waste

containers from entering the underground liquid effluent and oil drain tanks. Additionally, this Leased Premises is listed in Exhibit G of the GCEP Lease as a Leased Premises where hazardous substances were known to have been stored for one year or more, known to have been released, or disposed of. The identified hazardous substances in Exhibit G for the X-3002 building are DOE low level radiological waste and PCB/radiological waste. The Condition Report for the X-3002 building, developed at the time of turnover from DOE to Centrus and signed by both parties, stated that two contaminated areas were identified in Train 5. Prior to lease of the X-3002 building to Centrus, DOE removed all stored waste from the facility and completed remediation of contaminated areas to less than 10 CFR Part 835, Appendix D limits.

Evaluation of Activities Specific to Lead Cascade Building X-3012

The primary design function of the X-3012 building was to serve as the control room for centrifuge operations in the X-3001 and X-3002 buildings. Under the original GCEP program, the facility performed this function for the X-3001 building. The control room for the X-3002 building was not completed prior to shut down of the GCEP program. In addition to the control room function, it contained equipment used for analyzing process gas associated with the original GCEP program. The building also housed Maintenance personnel from the time of construction up to the time this document was developed.

A review of the historical activities in the X-3012 building was conducted to determine the potential for radiological contamination. Prior to commencing construction at the GCEP site, in 1977, ERDA-1549, *Portsmouth Gaseous Diffusion Plant Expansion Final Environmental Statement*, was performed and documented. A review of this document did not identify any pre-existing radiological burial sites or soil contamination areas on which the X-3012 building was constructed. Additionally, interviews with site personnel present during GCEP construction confirm no radiological conditions existed prior to the X-3012 building construction.

During the DOE Operational/Radiological Waste Storage period from 1979 to 2004, DOE utilized the GCEP site to demonstrate centrifuge enrichment capability and then for storage of radiological waste. The X-3012 building is divided into North and South sections. The North half contains the area originally intended to be the control rooms for the X-3001 and X-3002 buildings, as well as Assay Room 141 that contained equipment for analyzing process gas. The area also contains office space and facility electrical utilities. Other facility utilities are located on the mezzanine level of the North half of the X-3012 building. The South half of the X-3012 building houses maintenance areas, lunchroom and locker facilities, and a mezzanine for offices. There are three LEC and three Oily Water tanks associated with the X-3012 building. The LEC tanks are shared with the X-3001 and X-3002 buildings. The tanks provide a means for collecting drainage from areas that could contain substances of potential environmental insult. Tank contents are sampled and verified to determine the appropriate disposal path. Prior to shut down of the GCEP Program in 1985, Assay Room 141 was used for analyzing process gas via piping leading from the X-3001 building. Equipment in this area was removed at some point following shut down of the GCEP program. The area was converted to record storage and remained such until turn over to Centrus. No radiological waste was stored in this building.

Evaluation of Activities Specific to Lead Cascade Building X-7725

No processing of uranium has occurred in the X-7725 building since its construction. However, the facility has been used for storage of centrifuge components as well as DOE waste from the GDP.

While the X-7725 building is a large facility, the review pertains only to the areas utilized for activities associated with the Lead Cascade. These include:

- Buffer Storage Area
- Centrifuge Transporter Battery Room 161
- Centrifuge Transporter Maintenance Room 162
- Storage Room 373
- Northwest Offices, Lunchroom, and Locker Rooms (3 levels)
- Northwest Utility and Ventilation Room (4th floor)
- Northeast Receiving Area (1st floor)

Figure II.a-1 within Appendix C of this Decommissioning Plan depicts an area in the Northeast corner of the X-7725 building, first floor as being part of the Lead Cascade footprint. No radiological material handling was performed in this area during the span of the Lead Cascade operations.

A review of the historical activities in the X-7725 building Buffer Storage Area was conducted to determine the potential for radiological contamination. Prior to commencing construction at the GCEP site, in 1977, ERDA-1549, *Portsmouth Gaseous Diffusion Plant Expansion Final Environmental Statement*, was performed and documented. A review of this document did not identify any pre-existing radiological burial sites or soil contamination areas on which the X-7725 building was constructed. Additionally, interviews with site personnel present during GCEP construction confirm that no radiological conditions existed prior to the X-7725 building construction.

During the DOE Operational/Radiological Waste Storage period from 1979 to 2004, DOE utilized the GCEP site to demonstrate centrifuge enrichment capability and then for storage of radiological waste. The X-7725 building Buffer Storage Area contained no uranium processing equipment, but was used to house internally contaminated equipment as it was transported between the X-7726 facility and the X-3001 building. Rooms 161 and 162 were used for maintenance and storage of centrifuge transporter and associated equipment. This area was also used to store some centrifuge components. Upon shutdown of the program in 1985, a majority of the centrifuge equipment from the X-7725 building was moved to the X-3001 building. Areas of the X-7725 building were then transitioned to waste storage areas. Areas within the scope of this Decommissioning Plan utilized for waste storage was the Buffer Storage Area. Prior to lease of the areas of X-7725 building described in this Decommissioning Plan to Centrus, DOE removed the waste from these areas. There are two Process Water Drain Storage tanks associated with the X-7725 building. These are located on the Southeast corner of the facility and receive drainage from cooling and heating water systems. These tanks are not suspected to be radiologically contaminated.

This Leased Premises is listed in Exhibit G of the GCEP Lease as a Leased Premises where hazardous substances were known to have been stored for one year or more, known to have been released, or disposed of. The identified hazardous substances in Exhibit G for the X-7725 building are DOE low level radiological waste and PCB/radiological waste. The Condition Report for the X-7725 building, developed at the time of turnover from DOE to Centrus and signed by both parties, stated that most of the original GCEP equipment had been removed from the X-7725 building.

Evaluation of Activities Specific to Lead Cascade Facility X-7726

The primary design function of the X-7726 facility was to serve as the CTTF. The facility has been primarily used as an assembly area for centrifuges. Some process gas testing was performed in this facility during the original GCEP program.

A review of the historical activities in the X-7726 facility was conducted to determine the potential for radiological contamination. Prior to commencing construction at the GCEP site, in 1977, ERDA-1549, *Portsmouth Gaseous Diffusion Plant Expansion Final Environmental Statement*, was performed and documented. A review of this document did not identify any pre-existing radiological burial sites or soil contamination areas on which the X-7726 facility was constructed. Additionally, interviews with site personnel present during GCEP construction confirm that no radiological conditions existed prior to the X-7726 facility construction.

During the DOE Operational/Radiological Waste Storage period from 1979 to 2004, DOE utilized the GCEP site to demonstrate centrifuge enrichment capability and then for storage of radiological waste. The X-7726 facility has four distinct areas that are segregated from each other. Rooms 59 and 60 contain utilities for the facility and are located on the first floor, South of the centrifuge assembly area. Levels 2 and 3 of the X-7726 facility are primarily used as office space. The fourth floor of the X-7726 facility contains ventilation equipment related to the facility. The area of the X-7726 facility related to centrifuge activities (Assembly Stand Area) contains areas for storage of centrifuge components and for assembling centrifuges. A small area at the South end of the facility was utilized during the original GCEP program to operate centrifuges with process gas for testing and training purposes. The facility was also used to disassemble and repair contaminated centrifuges. There is one LEC tank associated with the X-7726 facility. The tanks provide a means for collecting drainage from areas that could contain substances of potential environmental insult. Tank contents are sampled and verified to determine the appropriate disposal path. No radiological waste was stored in this facility.

Evaluation of Activities Specific to Lead Cascade Corridor X-7727H

A review of the historical activities in the X-7727H Transfer Corridor was conducted to determine the potential for radiological contamination. Prior to commencing construction at the GCEP site, in 1977, ERDA-1549, *Portsmouth Gaseous Diffusion Plant Expansion Final Environmental Statement*, was performed and documented. A review of this document did not identify any pre-existing radiological burial sites or soil contamination areas on which the X-7727H corridor was constructed. Additionally, interviews with site personnel present during GCEP construction confirm that no radiological conditions existed prior to the X-7727H corridor construction.

During the DOE Operational/Radiological Waste Storage period from 1979 to 2004, DOE utilized the GCEP site to demonstrate centrifuge enrichment capability and then for storage of radiological waste. From 2004 to 2011, USEC Inc. (Centrus) began subleasing facilities in support of the American Centrifuge project. Centrus subleased the X-7727H corridor in 2004. The X-7727H corridor is a connecting corridor between the X-7725 building and the X-3001 and X-3002 buildings. This facility provides a means to transport equipment without impact from the outside elements. Located at the South end of the X-7727H corridor is an area that provides ingress and egress for equipment and materials. There was no radiological waste stored in these Leased Premises.

This Leased Premises is listed in Exhibit G of the GCEP Lease as a Leased Premises where hazardous substances were known to have been stored for one year or more, known to have been released, or disposed of. However, Exhibit G does not describe any specific hazardous material associated with the X-7727H corridor. No other documentation was located that identified the X-7727H corridor as an area used for long term storage of waste or as having radiologically contaminated areas. Interviews with personnel indicate the X-7727H corridor had been historically used only for the purpose of moving equipment between the X-7725 building and the process buildings or as a short-term accumulation area for materials prior to shipment. There is one LEC tank associated with the X-7727H corridor. The tank provides a means for collecting drainage from areas that could contain substances of potential environmental insult. Tank contents are sampled and verified to determine the appropriate disposal path. The Condition Report, developed at the time of turnover from DOE to Centrus and signed by both parties, did not mention the presence of radiological contamination in the X-7727H corridor.

☒ The procedures used to remediate the areas, and the disposition of radioactive material generated during the remediation

The Licensee does not have access to specific procedures and disposition documents associated with DOE activities. However, historical accounts by personnel present during these activities confirm that remediation of radiological material was performed in accordance with documented procedures and dispositioned in accordance with the appropriate regulatory requirements.

☒ A summary of the results of the final radiological evaluation of the previously remediated area

As discussed above, in February 2004, the Temporary Lease Agreement between USEC and DOE authorized expanding the GDP Leasehold to include facilities needed for the Lead Cascade and committed DOE to pay USEC for cleanup of GCEP contamination under the Regulatory Oversight Agreement. Additionally, the Temporary Lease required USEC to conduct a baseline radiological survey of all facilities needed for the Lead Cascade using statistical analysis methods to show with 95 percent confidence that the average removable and total contamination levels were less than the limits for surface contamination in 10 CFR Part 835, Appendix D. After GCEP cleanup was completed, Lead Cascade facilities leased under the Temporary Lease were transferred to Exhibit A of the GCEP lease. Before this transfer, any areas that did not meet the limits for surface contamination in 10 CFR Part 835, Appendix D were remediated. Completion of this remediation

and post remediation survey results were reported to the NRC via multiple letters in an effort to facilitate the transition of areas from the DOE regulatory oversight to the NRC.

Prior to being leased by USEC Inc., DOE and USEC Inc. representatives walked down each facility and documented the results in a Condition Report. This report documented the presence of radiological areas and equipment within the facilities at the time of turnover to Centrus. DOE provided oversight of radiological activities in accordance with DOE Orders from the time of facility construction to the date when each facility (or part thereof) was turned over to Centrus. At this time, radiological oversight transitioned to NRC programs described in the Licensee's licensing documents. Figure II.a-1 within Appendix C of this Decommissioning Plan depicts the GCEP Leased Premises currently being leased to the Licensee for the Lead Cascade NRC Materials License (SNM-7003).

The Licensee does not have access to DOE survey data which documents the radiological conditions that existed at the end of the 1985 operational period. However, a 1993 environmental audit conducted by DOE to determine their liability for legacy contamination under the GDP Lease, did report contaminated areas and contaminated equipment in some of the Lead Cascade buildings/facilities.

The Baseline Survey conducted as required by the Temporary Lease documents the radiological condition that existed prior to turnover of facilities to Centrus for the purpose of conducting Lead Cascade operations under the NRC Materials License (SNM-7003). This survey was conducted by USEC in accordance with a DOE approved survey plan, as part of the GCEP cleanup program and the results were reported to DOE via memo dated September 30, 2005. While the area under installed contaminated equipment was not surveyed, no contamination was found above the limits of 10 CFR Part 835, Appendix D outside of this area. Once the contaminated equipment was removed, subsequent surveys of the areas showed contamination levels less than Table 4.6-1 of the Lead Cascade License Application limits (cited in Section V.b of this Decommissioning Plan).

☒ A scale drawing or map of the site, facilities, and environs showing the locations of previous remedial activity

Figure II.a-1 within Appendix C of this Decommissioning Plan provides the map of the Lead Cascade footprint and is also a reasonable map of locations where previous remedial activity has occurred.

II.d. SPILLS

☒ A summary of areas at the site where spills (or uncontrolled releases) of radioactive material occurred in the past
☒ The types, forms, activities, and concentrations of radionuclides involved in the spill or uncontrolled release
☒ A scale drawing or map of the site, facilities, and environs showing the locations of spills

While Centrus has not had access to DOE occurrence reports made before the Lead Cascade License was approved, there is no record of spills or uncontrolled releases to the environment from

the GCEP facilities in any of the environmental reports prepared since GCEP was constructed. As discussed earlier, the presence of contaminated areas inside of these facilities confirms that some spills did occur inside of these facilities while under DOE regulation. However, these contaminated areas were remediated to less than the limits of 10 CFR Part 835, Appendix D before the NRC assumed regulatory responsibility for the Lead Cascade buildings/facilities.

Review of the Licensee's Corrective Action program confirms that during the life of the NRC Materials License (SNM-7003), there have been no spills (or uncontrolled releases) of radioactive material to the environment. There were, however, two contamination events during maintenance activities in the X-3001 building that are discussed elsewhere in this document.

II.e. PRIOR ONSITE BURIALS

☒ A summary of areas at the site where radioactive material has been buried in the past
☒ The types, forms, activities and concentrations of waste and radionuclides in the former burial
☒ A scale drawing or map of the site, facilities, and environs showing the locations of former burials

A site assessment performed in September 1977 (ERDA-1549, Volumes 1 and 2) to evaluate expansion of the enrichment capability at the Portsmouth DOE reservation, prior to construction at the GCEP site, documents the land upon which GCEP is built was previously a warehouse area where parts used to construct the GDP were stored until needed. All of it was outside of the security fence but inside of Perimeter Road. A review of these references did not identify any pre-existing radiological burial sites or soil contamination areas on which the X-3001 building was constructed. Additionally, interviews with site personnel present during GCEP construction confirm that no radiological conditions existed prior to the X-3001 building construction.

Additionally, during the life of the Lead Cascade, there has been no onsite burial of radioactive material; therefore, neither the types, forms, activities and concentrations of waste and radionuclides, or a scale drawing or map showing locations of former burials is needed.

III. FACILITY DESCRIPTION

III.a. SITE LOCATION AND DESCRIPTION

☒ The size of the site in acres or square meters
☒ The State and county in which the site is located

As discussed within Section 1.2.1.1 of the License Application and Section 3.1 of the Environmental Report, the DOE reservation is located on an approximately 3,708-acre parcel of DOE-owned land and is located in a rural area of Pike County in South Central Ohio. Specifically, the Lead Cascade facilities are located in the Southwestern portion of the DOE reservation.

☒ The names and distances to nearby communities, towns, and cities

The nearest residential center in this area is Piketon, which is about 4 miles (mi) North of the DOE reservation on U.S. Route 23. The county's largest community, Waverly, is about 8 mi North of the DOE reservation. Additional population centers within 50 mi of the reservation are Portsmouth, 27 mi South; Chillicothe, 27 mi North; and Jackson, 26 mi East. Figure 1.3-2 of the License Application provides the population within a 5-mi radius of the DOE reservation.

☒ A description of the contours and features of the site
☒ The elevation of the site
☒ A description of property surrounding the site, including the location of all off-site wells used by nearby communities or individuals
☒ The location of the site relative to prominent features such as rivers and lakes
☒ A map that shows the detailed topography of the site using a contour interval
☒ The location of the nearest residences and all significant facilities or activities near the site

Section 1.3 of the License Application and Chapter 3.0 of the Environmental Report describe the location and description, nearby roadways and bodies of water, and significant geographical features of the DOE reservation. The following figures are contained within the License Application:

- Figure 1.3-1 provides a topographic map of the DOE reservation
- Figure 1.3-5 provides the location of rivers and creeks in the vicinity of the DOE reservation
- Figure 1.3-6 provides the ponds and lagoons at the DOE reservation
- Figure 1.3-7 provides the elevations of roadways and of the surrounding areas of main process buildings

Additionally, Section 1.2 of the Integrated Safety Analysis (ISA) Summary describes nearby industrial, transportation, military, DOE, and American Centrifuge Plant activities in the vicinity of the DOE reservation.

☒ A description of the facilities (e.g., buildings, parking lots, and fixed equipment) at the site

A complete description of the Lead Cascade facilities and process is provided within Section 1.1 of the License Application.

III.b. POPULATION DISTRIBUTION

☒ A summary of the current population in and around the site, by compass vectors

Calendar year 2000 demographics surrounding the DOE reservation are described within Section 1.3.2 of the License Application. Specifically, Figure 1.3-2 of the License Application provides the population within a 5-mi radius of the DOE reservation and Figure 1.3-3 provides the special population centers within a 5-mi radius of the DOE reservation.

☒ A summary of the projected population in and around the site by compass vectors

The socioeconomic conditions within the region of influence (ROI) are described within Section 3.11 of the Environmental Report. The ROI population was projected to grow faster than the State during the current decade, increasing 6.2 percent between 2000 and 2010, compared to the State rate of 4.0 percent. Table 3.11-4 of the Environmental Report provides historic and projected populations in the ROI and the state.

III.c. CURRENT/FUTURE LAND USE

☒ A description of the current land uses in and around the site

Uses of nearby land and waters near the DOE reservation are described within Section 1.3.2.3 of the License Application and Section 3.2 of the Environmental Report.

☒ A summary of anticipated land uses

Following potential GCEP Lease termination, the leased premises would be returned to the DOE, which would determine any future use of this portion of the DOE reservation.

III.d. METEOROLOGY AND CLIMATOLOGY

☒ A description of the general climate of the region
☒ Seasonal and annual frequencies of severe weather phenomena
☒ Routine weather-related site deterioration parameters
☒ Extreme weather-related site deterioration parameters
☒ A description of the local (site) meteorology

A meteorology description of the site and its surrounding area is discussed within Section 1.3.3 of the License Application and Section 3.7 of the Environmental Report. The purpose of these sections is to provide meteorological information necessary to understand the regional weather phenomena of concern for the Lead Cascade operations and to understand the basis for the dispersion analyses performed. Additionally, the specifics of tornadoes and high winds were analyzed and are discussed within Section 1.3.1 of the ISA Summary.

☒ Weather-related radionuclide transmission parameters
☒ The National Ambient Air Quality Standards Category of the area in which the facility is located and, if the facility is not in a Category 1 zone, the closest and first downwind Category 1 Zone

The specifics of atmospheric emissions of radionuclides, both non-radiological and radiological, at the DOE reservation are discussed within Section 3.7.3 of the Environmental Report. Specifically, as discussed within Section 3.7.3.1 of the Environmental Report, the DOE reservation is located in a Class II prevention of significant deterioration area. The nearest Class I PSD area

is the Dolly Sods Wilderness Area, which is approximately 174 mi East of the DOE reservation in the State of West Virginia.

III.e. GEOLOGY AND SEISMOLOGY

- ☒ A detailed description of the geologic characteristics of the site and the region around the site
- ☒ A discussion of the tectonic history of the region, regional geomorphology, physiography, stratigraphy, and geochronology
- ☒ A regional tectonic map showing the site location and its proximity to tectonic structures
- ☒ A description of the structural geology of the region and its relationship to the site geologic structure
- ☒ A description of any crustal tilting, subsidence, karst terrain, landsliding, and erosion
- ☒ A description of the surface and subsurface geologic characteristics of the site and its vicinity
- ☒ A description of the geomorphology of the site
- ☒ A description of the location, attitude, and geometry of all known or inferred faults in the site and vicinity
- ☒ A discussion of the nature and rates of deformation
- ☒ A description of the seismicity of the site and region
- ☒ A complete list of all historical earthquakes that have a magnitude of 3 or more, or a modified Mercalli intensity of IV or more within 200 miles of the site

Geologic characteristics of the site and region are discussed within Section 1.3.6 of the License Application and Section 3.4 of the Environmental Report. Figure 1.3-10 of the License Application depicts the geologic cross section in the DOE reservation vicinity.

Specifically, as discussed within Section 1.3.6.5 of the License Application, there are no major geologic fault structures in the vicinity of the site and there have been no historic earthquake epicenters within less than 25 miles from the site. However, there have been eight earthquake epicenters within 50 miles. The maximum event had an epicenter intensity of over IV on the Modified Mercalli (MM) scale. However, these events were at the site with intensities between I and IV. The maximum peak ground acceleration of a MM level IV event roughly corresponds to 0.02 gravity. Historically, the maximum earthquake-induced peak ground acceleration experienced at the site was in 1955 and had a value of only 0.005 gravity. Figure III.e.-1 below provides the regional seismicity and tectonic features.

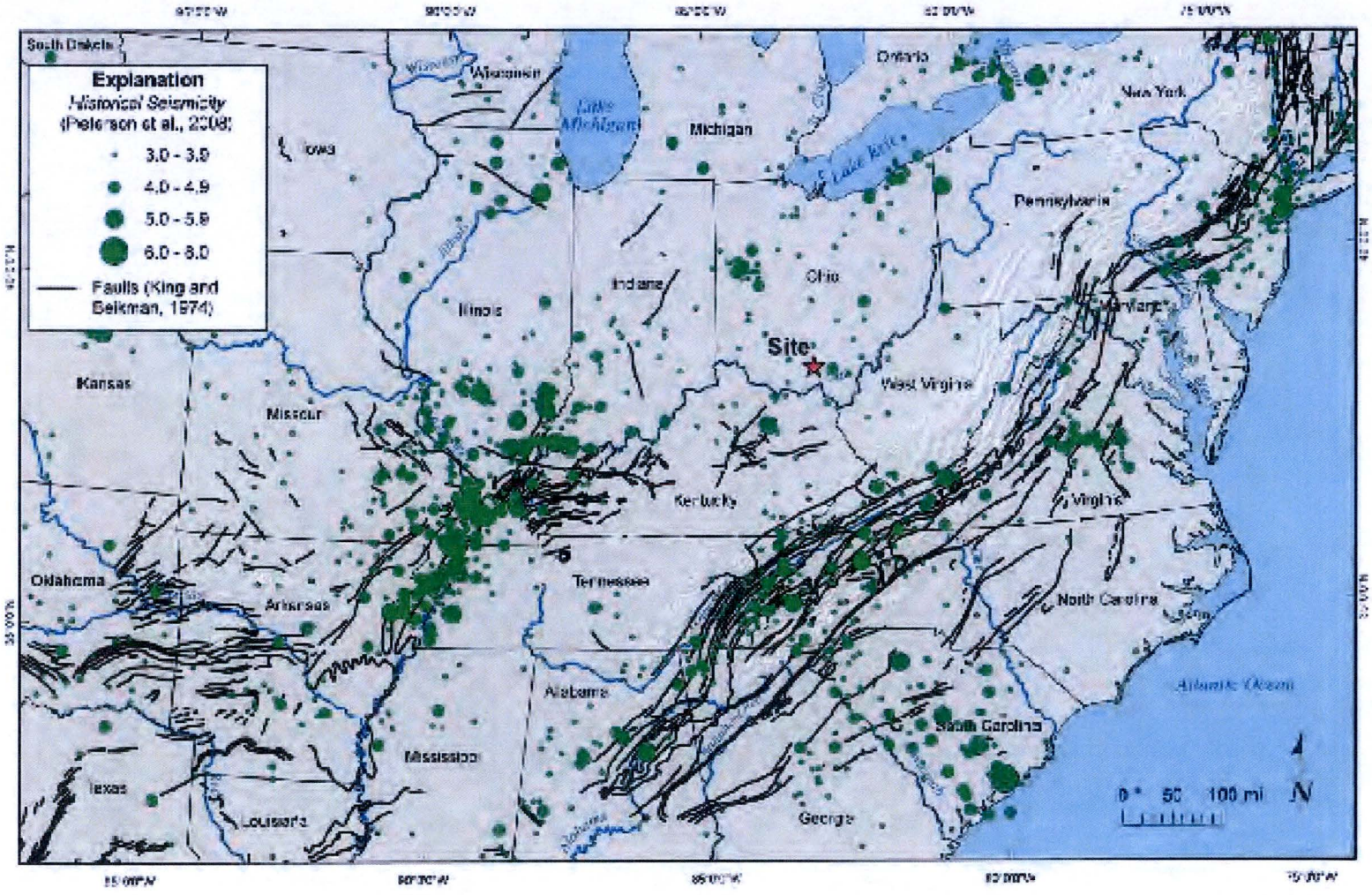


Figure III.e-1 Regional Seismicity and Tectonic Features

☒ A description of any man-made geologic features such as mines or quarries

There are no known specific man-made geologic features such as mines or quarries in proximity to or in association with the DOE reservation.

III.f. SURFACE WATER HYDROLOGY

☒ A description of site drainage and surrounding watershed fluvial features
☒ Water resource data including maps, hydrographs, and stream records from other agencies (e.g., U.S. Geological Survey and U.S. Army Corps of Engineers)
☒ Topographic maps of the site that show natural drainages and man-made features
☒ A description of the surface water bodies at the site and surrounding areas
☒ Flow-duration data that indicate minimum, maximum, and average historical observations for surface water bodies in the site areas
☒ Aerial photography and maps of the site and adjacent drainage areas identifying features such as drainage areas, surface gradients, and areas of flooding
☒ An inventory of all existing and planned surface water users, whose intakes could be adversely affected by migration of radionuclides from the site

Surface hydrology on and around the DOE reservation is described within Section 1.3.4 of the License Application and Section 3.5.1 of the Environmental Report. Specifically, Figure 1.3-5 of the License Application provides the location of rivers and creeks in the vicinity of the DOE reservation and Figure 1.3-6 provides the ponds and lagoons at the DOE reservation.

Additionally, as stated within Section 4.5 of the Environmental Report, potential impacts to surface water quality would be insignificant during operations of the Lead Cascade.

☒ A description of existing and proposed water control structures and diversions (both upstream and downstream) that may influence the site

There are no water control structures associated with the DOE reservation and none are currently foreseen in the future.

☒ Topographic and/or aerial photographs that delineate the 100-year floodplain at the site

As discussed within Section 1.3.4.1.3 of the License Application and Section 1.4.3 of the ISA Summary, the DOE reservation nominal elevation is 670 feet (ft) above mean sea level, which is about 130 ft above the normal stage of the Scioto River. The top-of-slab floor elevations for the Lead Cascade facilities are at approximately 671 ft. Figure 1.3-7 of the License Application provides elevations of the surrounding area of the DOE reservation.

Additionally, as discussed within Section 1.3.4.3 of the License Application, the DOE reservation elevation is greater than the maximum historic levels recorded for the Scioto River in the area and the 500-year flood predicted by the U.S. Army Corps of Engineers.

☒ A description of any man-made changes to the surface water hydrologic system that may influence the potential for flooding at the site

There are no man-made changes to the surface water hydrologic system that could influence flooding.

III.g. GROUND WATER HYDROLOGY

☒ A description of the saturated zone
☒ A description of the unsaturated zone
☒ A description of the numerical analyses techniques used to characterize the unsaturated and saturated zones

The subsurface hydrogeologic system in the Interior Low Plateaus region of Southern Ohio in the vicinity of the DOE reservation is described within Section 1.3.5 of the License Application and Section 3.5.2 of the Environmental Report.

☒ Descriptions of monitoring wells
☒ Physical parameters
☒ Information on all monitor stations including location and depth
☒ A description of physical parameters

There are no monitoring wells currently used at the Lead Cascade. As described in Section 4.12.3 of the Environmental Report, non-radiological and radiological environmental monitoring at the DOE reservation includes air, water, sediment, and biota. Environmental monitoring of both radiological and chemical parameters is required by State and Federal regulations, and/or permits, but is also completed to answer public concerns about the Lead Cascade operations.

☒ A description of ground water flow directions and velocities

The specifics of the main ground water flow unit beneath the DOE reservation are discussed within Section 1.3.5.2.3 of the License Application.

☒ The distribution coefficients of the radionuclides of interest at the site

There were no radioactive spills/incidents during Lead Cascade operations where radioactive material caused contamination of any ground water. Additionally, as stated within Section 4.5.3 of the Environmental Report, potential impacts to ground water quality would be insignificant during operations of the Lead Cascade.

III.h. NATURAL RESOURCES

☒ A description of the natural resources occurring at or near the site

The area specific to the Lead Cascade includes existing facilities formerly used for GCEP, and located in a fully developed industrial area. As such, the grounds are maintained as lawns and support various species of grasses and herbaceous dicots. Most natural resources have been previously discussed within Section III of this Decommissioning Plan; however, additional discussions related to ecological resources are discussed within Section 3.6 of the Environmental Report.

☒ A description of potable, agricultural, or industrial ground or surface waters

See previous Sections III.f. and III.g of this Decommissioning Plan for surface and ground water discussions.

☒ A description of economic, marginally economic, or subeconomic known or identified natural resources as defined in U.S. Geological Survey Circular 831

There are no economic, marginally economic, or subeconomic known or identified natural resources.

☒ Mineral, fuel, and hydrocarbon resources near and surrounding the site which, if exploited, would effect the licensee's dose estimates

There are no known mineral, fuel, or hydrocarbon resources to exploit near the DOE reservation.

IV. RADIOLOGICAL STATUS OF FACILITY

IV.a. CONTAMINATED STRUCTURES

☒ A list or description of all structures at the facility where licensed activities occurred that contain residual radioactive material in excess of site background levels
☒ A summary of the structures and locations at the facility that the licensee has concluded have not been impacted by licensed operations and the rationale for the conclusion
☒ A list or description of each room or work area within each of these structures
☒ A summary of the background levels used during scoping or characterization surveys
☒ A summary of the locations of contamination in each room or work area
☒ A summary of the radionuclides present at each location, the maximum and average radionulide activities in dpm/100cm^2, and, if multiple radionuclides are present, the radionuclide ratios
☒ The maximum and average radiation levels in mrem/hr in each room or work area

The historical discussion of the radiological condition of Lead Cascade buildings/facilities included in the scope of this Decommissioning Plan prior to Centrus lease of these facilities is included in Section II.c of this Decommissioning Plan. This section of the Decommissioning Plan describes the radiological status of these buildings/facilities as impacted by operations performed under the Lead Cascade Materials License (SNM-7003).

On June 17, 2002, USEC and the U.S. Government, represented by DOE, entered into an agreement (DOE-USEC Agreement), which has as one of its fundamental objectives to facilitate the deployment of cost-effective centrifuge enrichment technology in the United States. At the existing GCEP buildings/facilities in Piketon, Ohio, the first step in the DOE-USEC Agreement was to install and operate a gas centrifuge Lead Cascade inside existing buildings at the DOE Reservation based on up to 240 full-scale gas centrifuge machines and components. To operate the Lead Cascade, a 10 CFR Part 70 license was issued to USEC Inc. on February 24, 2004, to possess and use small quantities of enriched uranium (up to 250 kilograms of uranium hexafluoride [UF_6]).

The final step under the DOE-USEC Agreement was to construct and operate a commercial centrifuge plant using American Centrifuge technology. The Licensee received an approved materials license from the NRC for construction and operation of the ACP. While some construction activities were realized, no radiological operations for the commercial plant occurred prior to project termination in 2016.

The Lead Cascade buildings/facilities covered by this Decommissioning Plan are being decommissioned in preparation for termination of Lead Cascade Materials License (SNM-7003). At the time of submission of this Decommissioning Plan, all licensed material has been packaged and shipped from the Lead Cascade. No licensed material remains in

licensed space with the exception of residual radiological material. To evaluate which areas of the Lead Cascade buildings/facilities have been impacted by previous radiological operation, and which areas have not, an analysis of potential sources of residual contamination in these structures was conducted.

To evaluate which areas of the Lead Cascade Facilities have been impacted by previous radiological operation, and which areas have not, an analysis of potential sources of residual contamination in these structures was conducted. In addition to contamination from sources internal to the facility, the most likely external sources of radiological contamination identified in Section 3.6.3.6 of Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) were also considered. This section of MARSSIM poses several questions that relate to indirect means for contaminating a structure such as fall out from radiological air emissions elsewhere on the DOE Reservation or back up of shared utilities. The pathways listed below were evaluated to determine their potential for causing radiological contamination in each structure associated with the Lead Cascade facilities included in this Decommissioning Plan:

- Radiological contamination from process operation and handling of radioactive materials within the facility;
- Airborne activity from adjacent radiological roof vents;
- Transfer of loose contamination from radiological facilities by personnel;
- Construction of the facility on previously contaminated soil;
- Construction using contaminated materials;
- Contamination from utilities connected to radiological facilities; and
- Previously identified areas of contamination remediated by painting or other encapsulation methods.

The factors considered during these pathway evaluations are discussed in detail in the following paragraphs.

To identify sources of radiological concern from process operation and radioactive material handling, a review of radiological activities related to each Lead Cascade building/facility and conducted during the Centrus lease period was performed. This included a review of construction documents and Centrus operational data. Additionally, current radiological information from Centrus records was considered. The data shows all of the Lead Cascade facilities within the scope of this Decommissioning Plan have a radiological use history.

Historical meteorological data indicates wind direction is primarily from the South and Southwest which would tend to blow any contaminants from nearby sources away from the listed facilities. Therefore, contamination from releases or vent paths from other site radiological facilities is unlikely.

The transfer of contamination from a radiological facility to another facility is unlikely due to the programmatic requirements for personal and equipment surveys when exiting radiological areas. As a confirmation, radiological surveys of areas adjacent to process

areas in the listed facilities were performed as well as a search for radioactive material, with no issues identified.

The site assessment performed to evaluate expansion of the enrichment capability at the Portsmouth DOE reservation, prior to construction at the GCEP site, documents the land upon which GCEP is built was previously a warehouse area where parts used to construct the GDP were stored until needed. All of it was outside of the security fence but inside of Perimeter Road. This assessment confirms that no contaminated scrap was buried on this land and no contaminated soil removal was required to build GCEP.

Construction of the GCEP facilities, including the ones within the scope of this Decommissioning Plan, was performed in accordance with construction specifications that did not include radiological materials. As discussed above, radiological surveys confirmed radiation levels are not above background in these facilities.

Common utilities shared by facilities covered in this Decommissioning Plan and other facilities on the DOE reservation that process or have processed radioactive material are sanitary water, sanitary sewage, compressed air, and Recirculating Hot Water (RHW). Common site procedures require backflow prevention for all connections to the main sanitary water system to reduce the potential for reverse flow from connection points into the main water supply. Sewage systems from facilities included in this Decommissioning Plan are interconnected with each other and with other non-radiological facilities. However, the direction of flow of sewage from the Lead Cascade buildings/facilities is such that cross-contamination from another radiological facility is not considered a likely scenario. There have been no backups of sewage into Lead Cascade facilities from other facilities documented in the Licensee's Corrective Actions program. A review of the Licensee's Corrective Actions program did not identify any system issues that could have resulted in contamination of these facilities. Compressed air and RHW system connections are such that radiological contamination would not be able to enter the system causing cross-contamination.

There were no contaminated areas within the Lead Cascade where surfaces were painted over.

A summary of specific radiological status associated with each Lead Cascade building/facility included in this Decommissioning Plan is provided below:

Evaluation of Activities Specific to Lead Cascade Building X-3001

Centrus leased the X-3001 building from the DOE in April 2004. The Temporary Lease Agreement with the DOE required the performance of a baseline survey to establish the radiological condition of each leased facility for the purpose of determining the incremental radiological contamination levels caused by the Licensee's activities. The results of this survey for the X-3001 building indicated no areas of contamination greater than limits established in 10 CFR Part 835, Appendix D. At the time of turnover from DOE, the X-3001 building contained installed process equipment as well as original GCEP program

equipment stored for potential use by Centrus in the Lead Cascade. The DOE funded a project (GCEP Cleanup) to remove contaminated materials in Trains 1 through 4, including the legacy DOE centrifuges, during the period of 2004 to 2005. The results of post GCEP Cleanup surveys indicated no areas of contamination greater than limits established in 10 CFR Part 835, Appendix D. Some internally contaminated piping and equipment was left in place in Train 3 and the Utility Bay North of Train 3 (including the mezzanine area) in support of Lead Cascade operations. Potentially contaminated items also remained in Trains 6 and 8.

In August 2006, the Licensee received authorization from the NRC to introduce UF_6 into the Lead Cascade. Operations involving uranium occurred until the Lead Cascade shutdown in February 2016. During this time, uranium processing activities took place in the X-3001 building in Train 3 and the Utility Bay area North of Trains 2 and 3. A contamination control zone was established in the North half of the X-3001 building which required surveys of all potentially contaminated materials for removeable contamination upon exit. The Licensee employed a routine radiological survey program for Lead Cascade facilities, including the X-3001 building, during this operational period. Results of those surveys indicated two areas of contamination greater than the limits established in Table 4.6-1 of the License Application (cited in Section V.b of this Decommissioning Plan). Both areas are located in the North Utility Bay, one North of Train 2 and one North of Train 3. The contamination of these areas resulted from maintenance activities performed on contaminated support equipment.

In 2008, the Licensee removed all remaining radiological materials from Trains 6 and 8 and completed a post removal survey of this area in April 2008. The results of the survey confirmed that no contamination of facility surfaces occurred while performing the removal of this equipment. Following completion of this survey, the Licensee removed the concrete from the machine mounts in preparation for installation of centrifuges.

On March 2, 2016, the Licensee notified NRC of Centrus' decision to permanently cease operation at the Lead Cascade and to terminate the NRC Materials License (SNM-7003) following decontamination and decommissioning activities. Prior to shutdown of equipment, the Licensee purged and evacuated all uranium processing equipment to ensure it was devoid of process gas. Systems were then exposed to atmosphere for an extended period to ensure residual uranium was completely reacted. This minimized the possibility of releases during equipment removal. The North half of the facility continued to be the contamination control zone with contaminated equipment storage areas located in the Train 2 Utility Bay and the Train 4 Mezzanine. Centrifuges were moved from Train 3 to Train 6, using established radiological controls for removeable contamination. Steel plating was installed over centrifuge floor openings in Trains 3 and 4 to permit access for mobile equipment used for dismantling and packaging of equipment.

Removal of potentially contaminated equipment has been performed under the existing radiological controls program, controlling contamination as close to the source as possible. As of the date of this Decommissioning Plan submittal, the Licensee has removed, packaged, and shipped all contaminated or potentially contaminated equipment located in

the X-3001 building. This includes items with low potential for radiological contamination but which may have areas inaccessible to survey instruments. A small section of the vacuum system vent piping has been left in place where it penetrates the roof over the Utility Bay North of Train 3. This piping was surveyed to ensure radiological contamination was less than Table 4.6-1 of the License Application (cited in Section V.b of this Decommissioning Plan) limits for removeable contamination and the pipe section capped. Final cleanup of debris generated during decommissioning has been completed. The two areas of contamination identified during the operational period were decontaminated during the final cleanup process and final surveys indicate the contamination levels are less than Table 4.6-1 of the License Application levels (cited in Section V.b of this Decommissioning Plan). Trains 5, 6, 7, and 8 were utilized to store waste and load waste containers onto trucks for shipment during the decommissioning process.

Due to the high vacuum environment necessary for operating centrifuges, airborne contamination from leakage of UF_6 gas from process systems into the facility atmosphere is not likely. Airborne contamination could have resulted from leakage between the discharge of the vacuum pumps and the chemical traps where system pressure is near atmospheric pressure. This section of the system is relatively short and consists primarily of welded connections. This portion of the system is located in the Trains 2 and 3 utility bays. Operating procedures required systems to be purged and sampled for UF_6 gas content prior to opening, minimizing the possibility of releases to the atmosphere. The use of Engineering Controls (high efficiency particulate air filtered ventilation) was also required upon opening systems. Throughout the operational period, routine air sampling was performed in the uranium processing areas. None of these samples indicated levels greater than 0.1 percent of the Derived Air Concentration (DAC). A review of the Licensee's Corrective Actions program confirmed no reports of radiological releases occurred during the operational period. Radiological surveys of ventilation unit filters are performed during filter changes. None of these surveys indicated radiological contamination above the limits established in Table 4.6-1 of the License Application levels (cited in Section V.b of this Decommissioning Plan). Based on this information, it is unlikely facility structural components would be radiologically contaminated as a result of process system leakage.

Some areas of the X-3001 building include floor drains. This includes areas where centrifuges were installed. These drains flow into underground tanks located around the periphery of the facility. Prior to disposal of the tank contents, samples are taken to determine the radiological content. Once satisfactory results are obtained, the tank contents are transferred to mobile tanks, which are in turn dumped into the site sanitary water system. This system flows into a waste processing facility for the GCEP facilities, which is owned and operated by the DOE and its contractors. On one occasion, a sample from one of these tanks contained a level of uranium greater than minimum detectable but less than limits established by the DOE. An evaluation was performed and determined the likely source to be an accumulation of naturally occurring uranium constituents from the site water supply and diesel fuel/lubricants in the bottom of the tank from which the sample was taken. There have been no further samples at this location indicating an elevated

uranium level. Additional detail concerning these tanks is provided in Section XIV.d of this Decommissioning Plan.

There was one radiological vent for the X-3001 building. This vent contained an installed radiological monitoring system, including an alarm function. A review of the Licensee's Corrective Actions program indicated several alarm activations. Investigation of these alarms indicated the cause to be equipment related and not due to a radiological discharge. Surveys of the roof area surrounding the vent discharge pipe showed no removeable contamination above the limits established in Table 4.6-1 of the License Application (cited in Section V.b of this Decommissioning Plan).

Evaluation of Activities Specific to Lead Cascade Building X-3002

Centrus leased the X-3002 building from the DOE in May 2007 in preparation for commercial plant operations. Characterization surveys of the X-3002 building corridor and Train 4 indicated no areas of contamination greater than limits established in Table 4.6-1 of the License Application (cited in Section V.b of this Decommissioning Plan). Survey results are maintained in accordance with the Licensee's records management requirements.

The X-3002 building continued to be utilized by the Licensee as the boiler facility for the ACP. No radiological work was performed in this facility until the time of decommissioning. In May 2017, an evaluation was performed to extend the Lead Cascade MBA to the X-3002 building in preparation for upcoming decommissioning work. During the decommissioning period, radiological material containers were transported out of the X-3001 building to the X-3002 building for loading on to trucks. The transfer route in the X-3002 building was limited to the corridor between the North and South halves of the building and to the South end of Train 4. The change to the Lead Cascade MBA was temporary, with the extension expiring in December 2017.

Evaluation of Activities Specific to Lead Cascade Building X-3012

Centrus leased the X-3012 building from the DOE in April 2004. The Temporary Lease Agreement with the DOE required the performance of a baseline survey to establish the radiological condition of each leased facility for the purpose of determining the incremental radiological contamination levels caused by the Licensee's activities. At the time of turnover from DOE, the X-3012 building contained records from the original GCEP program. Removal of these records was included in the GCEP Cleanup project. The baseline survey results include those performed following removal of the records. The results of this survey for the X-3012 building indicated no areas of contamination greater than limits established in 10 CFR Part 835, Appendix D. No potentially contaminated areas remained following turn over from DOE.

In August 2006, the Licensee received authorization from the NRC to introduce UF_6 into the Lead Cascade. Operations involving uranium occurred until the Lead Cascade shutdown in February 2016. During this time, uranium processing activities took place in

the X-3001 building. Unlike the original GCEP program, analytical equipment for the Lead Cascade resided in the X-3001 building and as such no process gas was processed through the X-3012 building. A small area in the Southeast corner of the X-3012 building was utilized for the rework of contaminated equipment, primarily vacuum pump repairs. The floor in this location was covered with plastic prior to commencing work to minimize the possibility of contaminating facility surfaces. Radiological work in this area was performed under existing radiological programs.

On March 2, 2016, the Licensee notified NRC of Centrus' decision to permanently cease operation at the Lead Cascade and to terminate the NRC Materials License (SNM-7003) following decontamination and decommissioning activities. This includes removal of the radiological work area in the X-3012 building. At the time of submission of this Decommissioning Plan, all radiological areas within the X-3012 building have been removed.

Evaluation of Activities Specific to Lead Cascade Building X-7725

While the X-7725 is a large building, the scope of this Decommissioning Plan pertains only to the areas utilized for activities associated with the Lead Cascade. These include:

- Buffer Storage Area
- Centrifuge Transporter Battery Room 161
- Centrifuge Transporter Maintenance Room 162
- Storage Room 373
- Northwest Offices, Lunchroom, and Locker Rooms (3 levels)
- Northwest Utility and Ventilation Room (4^{th} floor)
- Northeast Receiving Area (1^{st} floor)

Figure II.a-1 in Appendix C of this Decommissioning Plan shows an area in the Northeast corner of the X-7725 building, first floor as being part of the Lead Cascade MBA. No radiological material handling was performed in this area during the span of the Lead Cascade license.

Centrus leased the portions of the X-7725 building described above from the DOE in June 2004. The Temporary Lease Agreement with the DOE required the performance of a baseline survey to establish the radiological condition of each leased facility for the purpose of determining the incremental radiological contamination levels caused by the Licensee's activities. The results of this survey for the specified areas of the X-7725 building indicate no areas of contamination greater than limits established in 10 CFR Part 835, Appendix D. At the time of turnover from DOE, the areas of the X-7725 building described above contained no radiological material.

In August 2006, the Licensee received authorization from the NRC to introduce UF_6 into the Lead Cascade. Operations involving uranium occurred until the Lead Cascade shutdown in February 2016. During this time, no uranium processing activities took place in the X-7725 building. However, the X-7725 building Buffer Storage Area was used to

store internally contaminated equipment. In addition, Room 161 was used as an area to prepare casings prior to centrifuge assembly. Room 162 was used as a Maintenance area for a short period as well, although no radiological work was performed in this location. The room was used to store radioactive material. Room 373 on the third floor of the X-7725 building was also used to store radioactive material.

On March 2, 2016, the Licensee notified NRC of Centrus' decision to permanently cease operation at the Lead Cascade and to terminate the NRC Materials License (SNM-7003) following decontamination and decommissioning activities. The X-7725 building Buffer Storage Area was used to store radiological waste and as a location for loading trucks for waste shipments. There was no leakage of radiological waste in this area.

Evaluation of Activities Specific to Lead Cascade Facility X-7726

Centrus leased the X-7726 facility, except for the Gas Test area and two floor drains posted as contaminated, from the DOE in February 2005. The Temporary Lease Agreement with the DOE required the performance of a baseline survey to establish the radiological condition of each leased facility for the purpose of determining the incremental radiological contamination levels caused by the Licensee's activities. The results of this survey for the X-7726 facility indicate no areas of contamination greater than limits established in 10 CFR Part 835, Appendix D. The DOE retained the Gas Test area and the posted drains until these were decontaminated and survey results were less than the limits established in 10 CFR Part 835, Appendix D. These areas were leased to Centrus in July 2007.

In August 2006, the Licensee received authorization from the NRC to introduce UF_6 into the Lead Cascade. Operations involving uranium occurred until the Lead Cascade shutdown in February 2016. During this time, the X-7726 facility Assembly Stand Area was used to assemble centrifuges for the Lead Cascade project. Repair of contaminated centrifuges was also performed in this facility. the Licensee installed a vacuum system in the X-7726 facility to support centrifuge testing. This system was administratively limited for use on non-radiological equipment. Radiological work in this area was performed under existing radiological programs. Rooms 59 and 60 are part of the X-7726 facility but are physically separated from the Assembly Stand area. These rooms contain utilities to support facility operation. Additionally, ventilation equipment is located on the 4^{th} floor. This area is also physically separated from the Assembly Stand area. A review of the Licensee's Corrective Actions program did not identify any radiological releases within the X-7726 facility.

On March 2, 2016, the Licensee notified NRC of Centrus' decision to permanently cease operation at the Lead Cascade and to terminate the NRC Materials License (SNM-7003) following decontamination and decommissioning activities. During the decommissioning activities, the X-7726 facility was used to prepare contaminated centrifuges and components for waste disposal. Tooling and fixtures used in the waste packaging process have been dispositioned.

Evaluation of Activities Specific to Lead Cascade Corridor X-7727H

Centrus leased the X-7727H corridor from the DOE in April 2004. Operations involving uranium occurred until the Lead Cascade shutdown in February 2016. The Temporary Lease Agreement with the DOE required the performance of a baseline survey to establish the radiological condition of each leased facility for the purpose of determining the incremental radiological contamination levels caused by the Licensee's activities. At the time of turnover from DOE, the X-7727H corridor contained office equipment from the original GCEP program. The results of this survey for the X-7727H corridor indicated no areas of contamination greater than limits established in 10 CFR Part 835, Appendix D.

On March 2, 2016, the Licensee notified NRC of Centrus' decision to permanently cease operation at the Lead Cascade and to terminate the NRC Materials License (SNM-7003) following decontamination and decommissioning activities. During this period, the X-7727H corridor has continued to serve as a conduit for moving materials between the X-7725 building and the process buildings. In addition, the facility was utilized for short-term storage of waste in preparation for shipment. No leakage of waste occurred during this period.

Summary of Radiological Condition in the Lead Cascade Facilities

When DOE funding for Lead Cascade activities was curtailed in 2015, Centrus began planning for the eventual shutdown and decommissioning of the Lead Cascade. To provide input to this planning effort a radiological survey was conducted to determine if there had been any change to the radiological conditions that existed before the Lead Cascade was constructed as documented in the Baseline Survey that was required by the 2004 Temporary Lease discussed earlier in this Decommissioning Plan. This radiological survey which is referred to in this Decommissioning Plan as the "Scoping Survey" was conducted in 2015 using the same instruments and methodology used during the 2004 Baseline Survey. The results of this survey document that, with the exception of two areas in X-3001 building, there had been no significant increase in survey readings measured during the 2004 Baseline Survey.

Based on the 2015 scoping survey the probability of exceeding the proposed DCGL (50,000 dpm/100 square centimeters) anywhere in the Lead Cascade buildings/facilities during the Facility Status Survey is extremely low. While the probability of exceeding the proposed limit for the Facility Status Survey (5,000 dpm/100 square centimeters) is more likely, the only areas of concern are those that were significantly more contaminated in 2015 than they were in 2004. These have been remediated below this level. The results of the survey are summarized in Table IV.a-1 below:

Table IV.a-1 2015 Baseline Verification Summary						
	Beta dpm/100 cm^2			Alpha dpm/100 cm^2		
Area	Ave.	1 SD	Max	Ave.	1 SD	Max
X-7725 BSA	362	186	700	-3	18	33
X-3001 Transfer Corridor	553	203	891	46	40	121
X-3012 Maintenance	569	113	745	-4	19	44
X-7727H	543	169	800	115	69	241
Total for Survey 1	477	192	891	25	57	241
X-7726 (CTTF)	194	667	1,781	-1	24	33
X-3001 N Mezzanine	718	178	1,136	39	25	103
X-3001 Train 3	650	191	1,101	17	28	88
X-3001 N Utility Bay	643	411	2,711	75	314	1,729
Lead Cascade Equipment / Components	-469	579	3,881	27	34	141
Concrete Floors (all areas)	597	274	2,711	29	125	1729
All removable contamination samples < MDA						
Survey 1 areas chosen based on contamination potential						

Table IV.a-2 below provides a summary of radiological conditions in areas of the Lead Cascade footprint at the time the 2015 Scoping Survey was performed. Of note, since the Scoping Survey was conducted in 2015, all classified and/or contaminated equipment in the Lead Cascade has been removed, packaged, and shipped to NNSS for permanent burial and the two contaminated areas in the X-3001 building have been decontaminated.

Table IV.a-2 Summary of Current Radiological Conditions of Lead Cascade Facilities/Buildings

Building	Location or Area	Description of Activities	Posting/ controls	Radiological Conditions**
X-3001	North	Lead Cascade equipment included centrifuge machines, piping, valves, etc. Components and equipment were internally contaminated with uranium; assays ranging from depleted (> 0.2 wt. percent) to a maximum of 10 wt. percent. Train 3 is on a quarterly routine survey frequency and work location surveyed after maintenance and machine disconnects to verify posting is appropriate. Periodically, Contamination Control Zones (CCZs) or Contaminated Areas (CA) are established for specific work and down posted after surveyed. Routine air samplers are operating and grab samples are collected during selected operations. Trains 1 and 2 were not utilized during Lead Cascade operations. Train 4 was used for interim storage of shipping containers of Lead Cascade equipment.	Radioactive Material Area (RMA) with RWPs controlling specific tasks.	Removable contamination levels: α <200 dpm/100 cm^2 β <700 dpm/100 cm^2 Total contamination levels α <400 dpm/100 cm^2 β <5,000 dpm/100 cm^2 Radiation levels <10 µR/hour except as noted at Feed and Dump Carts.
X-3001	Feed Cart	Feed cart was located in a small area (roughly 10 inch [in.] x 20 in.) in Train 3 used to feed UF_6 to cascade(s). Maximum amount of material limited to one 12 in. cylinder containing natural assay uranium. Feed Cart was on a monthly routine survey frequency for removable contamination and surveys performed after each cylinder hook up and disconnect or maintenance work. Routine air monitoring was performed at the Feed Cart and grab samples were collected during selected operations. Feed cart was packaged and shipped for disposal.	RMA with RWP controlling operation of Feed Cart.	Removable contamination levels: α <200 dpm/100 cm^2 β <700 dpm/100 cm^2 Total contamination levels α <400 dpm/100 cm^2 β <5,000 dpm/100 cm^2

Table IV.a-2 Summary of Current Radiological Conditions of Lead Cascade Facilities/Buildings

Building	Location or Area	Description of Activities	Posting/ controls	Radiological Conditions**
X-3001	Dump Carts	Carts located in Train 3 were used to remove UF_6 from cascade(s). Carts were on a monthly routine survey frequency for removable contamination and surveys were performed after each cylinder hook up and disconnect or maintenance work. Grab air samples were collected during selected operations. Dump carts have been packaged and shipped for disposal.	RMA with RWP controlling operation	Removable contamination levels: α <200 dpm/100 cm^2 β <700 dpm/100 cm^2 Total contamination levels α <400 dpm/100 cm^2 β <5,000 dpm/100 cm^2
X-3001	Sample Carts	Carts located in Train 3 were used to remove UF_6 samples from cascade(s) when required. Carts were on a monthly routine survey frequency for removable contamination and surveys performed after each sampling evolution or maintenance work. Grab samples or Breathing Zone (BZ) samples were collected during sampling operations. Sample carts have been packaged and shipped for disposal.	RWP controlling operation	Removable contamination levels: α <200 dpm/100 cm^2 β <700 dpm/100 cm^2 Total contamination levels α <400 dpm/100 cm^2 β <5,000 dpm/100 cm^2
X-3001	Mass Spectrometer (MS) Room	In addition to housing MSs, the MS served as Local Control Center to back up the Area Control Room (ACR). Room was on a monthly routine survey frequency for removable contamination and surveys performed after each maintenance work. Routine air monitoring was performed in the MS room. The room has been demolished and removed.	RMA	Removable contamination levels: α <200 dpm/100 cm^2 β <700 dpm/100 cm^2 Total contamination levels α <400 dpm/100 cm^2 β <5,000 dpm/100 cm^2 Radiation levels 60 µR/hour maximum
X-3001	Mezzanine	Mezzanine contains Battery Rooms, and Vent Stack monitor. Primary radiological concern was the Vent Stack monitoring equipment. Samples changed weekly and post	RMA	Removable contamination levels: α <200 dpm/100 cm^2 β <700 dpm/100 cm^2

Table IV.a-2 Summary of Current Radiological Conditions of Lead Cascade Facilities/Buildings

Building	Location or Area	Description of Activities	Posting/ controls	Radiological Conditions**
		sample change surveys performed, no evidence of spread of contamination. Mezzanine is on an annual routine survey frequency. Lead cascade headers and contaminated components have been removed.		Total contamination levels α <400 dpm/100 cm^2 β <5,000 dpm/100 cm^2
X-3001	Utility Area	Area located directly North of Cascade, contained Lead Cascade auxiliary equipment including Purge Vacuum (PV) pumps and Chemical Traps. In addition, area used to store contaminated components. Work on contaminated Lead Cascade equipment was routinely performed in the Train 2 Utility Bay under special RWP and area surveyed upon completion. Train 3 Utility Bay contained the majority of process equipment and piping necessary to support Lead Cascade operations. Trains 1 and 4 Utility Bays were minimally impacted during Lead Cascade operations. Area is on an annual routine survey frequency. All vacuum pumps and chemical traps, as well as much of the auxiliary equipment, has been packaged and shipped for disposal.	RMA	Removable contamination levels: α <200 dpm/100 cm^2 β <700 dpm/100 cm^2 Total contamination levels α <400 dpm/100 cm^2 β <5,000 dpm/100 cm^2 Utility Bay 3 had elevated contamination due to incident in 2013, total contamination on the floor (<3 m^2) was 1,729 dpm alpha/100 cm^2 and 2,711 dpm beta/100 cm^2 noted in the 2015 Scoping Survey. An area in Utility Bay 2 (< 9 m^2) with fixed contamination due to work on contaminated equipment. Maximum levels prior to remediation indicated 9,257 dpm/100 cm^2 alpha and 20,792 dpm/100 cm^2 beta. Both areas have been remediated and current survey data indicates the areas are below Table 4.6-1 of the License Application levels (cited in Section V.b of this Decommissioning Plan).

Table IV.a-2 Summary of Current Radiological Conditions of Lead Cascade Facilities/Buildings

Building	Location or Area	Description of Activities	Posting/ controls	Radiological Conditions**
X-3001	Transfer Corridor	Area typically contains no radioactive material; however, centrifuge machines and components were transported to X-7726 facility and X-7725 building for storage and maintenance. Due to potential contamination, the Transfer Corridor is on a quarterly routine removable contamination survey frequency. Personal Contamination Monitors are on a monthly removable contamination survey.	None – contaminated components tagged and transported under escort	Removable contamination levels: α <200 dpm/100 cm^2 β <700 dpm/100 cm^2 Total contamination levels α <400 dpm/100 cm^2 β <5,000 dpm/100 cm^2
X-3001	South Half of Building Trains 5-8 Mezzanine and Utility Area	Area surveyed during Baseline survey project average total contamination levels were 41 dpm/100 cm^2 alpha and 903 dpm/100 cm^2 beta and removable contamination levels < 20 dpm/100 cm^2. Prior to 2009, Train 6 was posted as a RMA, used for storage of GCEP equipment; however, equipment removed, clearance surveys performed, and posting removed. Area was on an annual survey frequency until 2011. Areas may be established in Train 6 for selected work performed under a RWP (work on Gulpers, for example). Area was also used for storage of centrifuges and is now used for temporary storage of equipment. Trains 5, 7, and 8 were used to store sealed containers of Lead Cascade components waiting shipment.	RMA	2011 data indicates Removable contamination levels: α <200 dpm/100 cm^2 β <700 dpm/100 cm^2 Total contamination levels α <400 dpm/100 cm^2 β <5,000 dpm/100 cm^2
X-7727H	Transfer Corridor	Area typically contains no radioactive material; however, centrifuge machines and components were transported to X-7726 facility and X-7725 building for storage and maintenance.	RMA	Removable contamination levels: α <200 dpm/100 cm^2 β <700 dpm/100 cm^2 Radiation levels 6 μR/hour maximum

Table IV.a-2 Summary of Current Radiological Conditions of Lead Cascade Facilities/Buildings

Building	Location or Area	Description of Activities	Posting/ controls	Radiological Conditions**
		In addition, loaded transport conveyances were stored in this area pending final shipment for disposal. An annual routine survey program for removable contamination and penetrating radiation is maintained. Contaminated components are tagged and transported under escort. The transfer corridor is used as a staging area for shipments before departure to NNSS.		
X-7725	Buffer Storage Area	Area used to store contaminated centrifuge machines and equipment. Each machine is labeled and temporary posting is established for groups of material. Minor maintenance and component removal may be performed in this area and work controlled by RWP or continuous Health Physics (HP) coverage. Grab air samples and BZ samples are collected as determined by HP (last performed in 2010). Shipping containers were stored in the Buffer Storage Area waiting final shipment for disposal. Area is on an annual survey frequency.	RMA	Removable contamination levels: α <200 dpm/100 cm^2 β <700 dpm/100 cm^2 Total contamination levels α <400 dpm/100 cm^2 β <5,000 dpm/100 cm^2
X-7725	Room 373	Room contained RMA for storage of contaminated components/parts. Room is on an annual survey frequency.	RMA	Removable contamination levels: α <200 dpm/100 cm^2 β <700 dpm/100 cm^2 Total contamination levels α <400 dpm/100 cm^2 β <5,000 dpm/100 cm^2

Table IV.a-2 Summary of Current Radiological Conditions of Lead Cascade Facilities/Buildings

Building	Location or Area	Description of Activities	Posting/ controls	Radiological Conditions**
X-7725, X-7726, and X-3012	Office Areas	Office areas in the X-7725 building, X-7726 facility, and X-3012 building (including ACR) contain no radioactive material and are on an annual survey frequency.	No permanent postings	Removable contamination levels: α <200 dpm/100 cm^2 β <700 dpm/100 cm^2 Total contamination levels α <400 dpm/100 cm^2 β <5,000 dpm/100 cm^2
X-7725 and X-3012	Change Rooms	Change rooms, two each in the X-7725 and X-3012 buildings, are on a monthly survey frequency.	No permanent postings	Removable contamination levels: α <200 dpm/100 cm^2 β <700 dpm/100 cm^2 Total contamination levels α <400 dpm/100 cm^2 β <5,000 dpm/100 cm^2
X-7725 and X-3012	Lunch Rooms	X-3012 building is on a quarterly frequency. (Becomes daily routine contamination survey when a CA is established in the maintenance area). X-7725 building is on a weekly frequency due to increased traffic and food service provided in this area.	No permanent postings	Removable contamination levels: α <200 dpm/100 cm^2 β <700 dpm/100 cm^2 Total contamination levels α <400 dpm/100 cm^2 β <5,000 dpm/100 cm^2
X-3012	Maintenance Areas	Maintenance areas are on an annual survey frequency. Areas may be established to perform work on contaminated components and are extensively surveyed for removable contamination prior to down posting.	No permanent postings	Removable contamination levels: α <200 dpm/100 cm^2 β <700 dpm/100 cm^2 Total contamination levels α <400 dpm/100 cm^2 β <5,000 dpm/100 cm^2
X-7726	CTTF (Excluding 2nd and 3rd floor offices)	Area used for machine assembly and disassembly. Area is also the primary shipping and receiving area for classified centrifuge components.	RMA	Removable contamination levels: α <200 dpm/100 cm^2 β <700 dpm/100 cm^2

Table IV.a-2 Summary of Current Radiological Conditions of Lead Cascade Facilities/Buildings

Building	Location or Area	Description of Activities	Posting/ controls	Radiological Conditions**
		Work on contaminated machines is controlled by RWPs. CCZ/CAs are established during selected work activities, surveyed, and down posted when no longer needed. Routine Survey Frequencies: • Assembly Stand - Quarterly • Break Room – Daily • Room 156 – Weekly due to ongoing work in area • Continuous air sampling is performed, and grab and BZ sampling is performed during selected work.		Total contamination levels α <400 dpm/100 cm^2 β <5,000 dpm/100 cm^2 Radiation – 20 µR/hour maximum.
X-3002	Process Building (Corridor and South half of Train 4	Area temporarily used during shipping campaign for inclement weather conditions to allow for loading of trailers and vehicle transport surveys. Building corridor and the South half of Train 4 were used for these efforts.	None	Latest data indicates: Total contamination levels α <400 dpm/100 cm^2 β <5,000 dpm/100 cm^2 Radiation – 20 µR/hour maximum

** Most of the information contained within this table was gathered from the 2015 routine survey data.

Impacted and Non-Impacted Areas within the Lead Cascade Buildings/Facilities

Table IV.a-3 below designates the impacted and non-impacted areas within the scope of this Decommissioning Plan. Additionally, this table provides justification for declaring an area to be not impacted by these activities. Of note, since the presence of any areas which exceeded the limits of 10 CFR Part 835, Appendix D (also limit for FSS) was well known at the time of sublease, the Licensee made this determination based of this known condition and any changes to this condition which would be caused by the Licensee's radiological activities conducted after the sublease.

Table IV.a-3 Summary of Impacted and Non-Impacted Areas Within Lead Cascade Facilities/Buildings

Building	Room/Area	Impacted	Non-Impacted
X-3001	Train 1	Floor areas only	Machine mount holes, centrifuge drains, and building support columns are not considered impacted since no radiological materials were handled in this area during the license period of the Lead Cascade operation.
X-3001	Utility Bay Area North of Train 1	Floor areas and drains	Utility equipment and building structural components are not considered impacted since no radiological materials were handled in this area during the license period of the Lead Cascade operation and there were no releases reported in the vicinity of this area.
X-3001	Utility Area Mezzanine North of Train 1	Floor areas and ventilation units	Exterior of utility equipment and building structural components are not considered impacted since no radiological materials were handled in this area during the license period of the Lead Cascade operation and there were no releases reported in the vicinity of this area.
X-3001	Train 1 Stairwell	Floor areas and stairs/handrail	Building structural components are not considered impacted since no radiological materials were handled in this area during the license period of the Lead Cascade operation and there were no releases reported in the vicinity of this area.
X-3001	Diesel Generator Room 1/2	Floor areas only	Exterior of utility equipment and building structural components are not considered impacted since no radiological materials were handled in this area during the license period of the Lead Cascade operation and there were no releases reported in the vicinity of this area.
X-3001	Train 2	Floor areas only	Machine mount holes, centrifuge drains, and building support columns are not considered impacted since no radiological materials were handled in this area during the license period of the Lead Cascade operation.

Table IV.a-3 Summary of Impacted and Non-Impacted Areas Within Lead Cascade Facilities/Buildings

Building	Room/Area	Impacted	Non-Impacted
X-3001	Utility Bay Area North of Train 2	Floor areas, drains, and walls/building columns. This location contained a small area of contamination that was remediated to levels below the established DCGL. This area was the result of a maintenance evolution on a vacuum pump.	Building support columns above 2 meters are not considered impacted since there were no reported releases in this area during the license period of the Lead Cascade operation. Facility utility equipment in this area is not considered impacted since the contamination from the maintenance evolution was highly localized and no releases of radiological materials from operating systems was reported.
X-3001	Utility Area Mezzanine North of Train 2	Floor areas, walls, and ventilation units	Exterior of utility equipment are not considered impacted since there were no releases reported in the vicinity of this area.
X-3001	Battery Room 1/2	Floor areas only	Exterior of utility equipment and building structural components are not considered impacted since no radiological materials were handled in this area during the license period of the Lead Cascade operation and there were no releases reported in the vicinity of this area.
X-3001	Train 3	Floor areas, machine mount holes, centrifuge drains and building columns up to a height of 2 meters. Train 3 is the location where centrifuges processed Uranium for the purpose of demonstrating separation of isotopes.	Building columns above the height of 2 meters since there were no releases from operating equipment in this area.
X-3001	Utility Bay Area North of Train 3	Floor areas, drains, walls/building columns, and overhead areas. This location contained a small area of contamination that was remediated to levels below the established DCGL. This area was the result of a maintenance evolution on a vacuum pump.	Facility utility equipment in this area is not considered impacted since the contamination from the maintenance evolution was highly localized and no releases of radiological materials from operating systems was reported.
X-3001	Utility Area Mezzanine North of Train 3	Floor areas, walls, and ventilation unit	Exterior of utility equipment are not considered impacted since there were no releases reported in the vicinity of this area.

Table IV.a-3 Summary of Impacted and Non-Impacted Areas Within Lead Cascade Facilities/Buildings

Building	Room/Area	Impacted	Non-Impacted
X-3001	Battery Room 3/4	Floor areas only	Exterior of utility equipment and building structural components are not considered impacted since no radiological materials were handled in this area during the license period of the Lead Cascade operation and there were no releases reported in the vicinity of this area.
X-3001	North Elevator, Receiving Area, and Restroom	Floor areas only	Exterior of utility equipment and building structural components are not considered impacted since no radiological materials were handled in this area during the license period of the Lead Cascade operation and there were no releases reported in the vicinity of this area.
X-3001	Train 4	Floor areas, machine mount holes, centrifuge drains and building columns up to a height of 2 meters. With the exception of centrifuges which were moved using an overhead crane directly to the machine transporter, Train 4 was used as a primary transport route for radiological materials in and out of the X-3001 North Contamination Control Zone.	Building support columns above 2 meters are not considered impacted since there were no reported releases in this area during the license period of the Lead Cascade operation. The high vacuum operating characteristics of the centrifuge process also supports this approach.
X-3001	Utility Bay Area North of Train 4	Floor areas and drains	Utility equipment and building structural components are not considered impacted since no radiological materials were handled in this area during the license period of the Lead Cascade operation and there were no releases reported in the vicinity of this area.
X-3001	Utility Area Mezzanine North of Train 4	Floor areas, walls, and ventilation units	Exterior of utility equipment are not considered impacted since there were no releases reported in the vicinity of this area.
X-3001	Train 4 Stairwell	Floor areas and stairs/handrails	Building structural components are not considered impacted since no radiological materials were handled in this area during the license period of the Lead Cascade operation and there were no releases reported in the vicinity of this area.

Table IV.a-3 Summary of Impacted and Non-Impacted Areas Within Lead Cascade Facilities/Buildings

Building	Room/Area	Impacted	Non-Impacted
X-3001	Diesel Generator Room 3/4	Floor areas only	Exterior of utility equipment and building structural components are not considered impacted since no radiological materials were handled in this area during the license period of the Lead Cascade operation and there were no releases reported in the vicinity of this area.
X-3001	Train 5	Floor areas only. Train 5 was used to store and handle radiological materials during the dismantling of the Lead Cascade equipment during decommissioning. This material was surveyed and verified free of loose surface contamination prior to exit from the north Contamination Control Zone.	Machine mount holes, centrifuge drains, and building support columns are not considered impacted since no radiological materials with loose surface contamination were handled in this area during the license period of the Lead Cascade operation and there were no reports of releases from this radiological material.
X-3001	Utility Bay Area South of Train 5	None	This area is not impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3001	Utility Area Mezzanine South of Train 5	None	This area is not impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3001	Train 5 Stairwell	None	This area is not impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3001	Diesel Generator Room 5/6	None	This area is not impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3001	Train 6	Floor areas only. Train 6 was used to store and handle radiological materials during the dismantling of the Lead Cascade equipment during decommissioning. This material was surveyed and verified free of loose surface contamination prior to exit from the north Contamination Control Zone.	Machine mount holes, centrifuge drains, and building support columns are not considered impacted since no radiological materials with loose surface contamination were handled in this area during the license period of the Lead Cascade operation and there were no reports of releases from this radiological material.
X-3001	Utility Bay Area South of Train 6	None	This area is not impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.

Table IV.a-3 Summary of Impacted and Non-Impacted Areas Within Lead Cascade Facilities/Buildings

Building	Room/Area	Impacted	Non-Impacted
X-3001	Utility Area Mezzanine South of Train 6	None	This area is not impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3001	Battery Room 5/6	None	This area is not impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3001	Train 7	Floor areas only. Train 7 was used to store and handle radiological materials during the dismantling of the Lead Cascade equipment during decommissioning. This material was surveyed and verified free of loose surface contamination prior to exit from the north Contamination Control Zone.	Machine mount holes, centrifuge drains, and building support columns are not considered impacted since no radiological materials with loose surface contamination were handled in this area during the license period of the Lead Cascade operation and there were no reports of releases from this radiological material.
X-3001	Utility Bay Area South of Train 7	None	This area is not impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3001	Utility Area Mezzanine South of Train 7	None	This area is not impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3001	Battery Room 7/8	None	This area is not impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3001	South Elevator, Receiving Area, and Restroom	None	This area is not impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3001	Train 8	Floor areas only. Train 8 was used to store and handle radiological materials during the dismantling of the Lead Cascade equipment during decommissioning. This material was surveyed and verified free of loose surface contamination prior to exit from the north Contamination Control Zone.	Machine mount holes, centrifuge drains, and building support columns are not considered impacted since no radiological materials with loose surface contamination were handled in this area during the license period of the Lead Cascade operation and there were no reports of releases from this radiological material.

Table IV.a-3 Summary of Impacted and Non-Impacted Areas Within Lead Cascade Facilities/Buildings

Building	Room/Area	Impacted	Non-Impacted
X-3001	Utility Bay Area South of Train 8	None	This area is not impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3001	Utility Area Mezzanine South of Train 8	None	This area is not impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3001	Train 8 Stairwell	None	This area is not impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3001	Diesel Generator Room 7/8	None	This area is not impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3001	Train 8 Annex	None	This area is not impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3001	Transfer Corridor	Floor areas only	Fencing and building structural components are not considered impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3001	Crane Access Stairwells	Landings, stairs and handrails	Building structural components are not considered impacted since no radiological materials were handled in this area during the license period of the Lead Cascade operation and there were no releases reported in the vicinity of this area.
X-3002	Train 4 South Half	Floor areas only	Building structural components are not considered impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3002	Transfer Corridor	Floor areas only	Building structural components are not considered impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.

Table IV.a-3 Summary of Impacted and Non-Impacted Areas Within Lead Cascade Facilities/Buildings

Building	Room/Area	Impacted	Non-Impacted
X-3012	South Side Maintenance Shops	Floor areas and work benches	Building structural components are not considered impacted since the radiological activities performed in this area were conducted under the licensed radiological program, equipment contained minimal levels of removable radioactivity, and the work performed did not generate airborne radioactivity.
X-3012	South Side Mezzanine	Floor areas only	Building structural components are not considered impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3012	North Side Area Control Room	Floor areas only	Building structural components are not considered impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3012	Northwest Side Office Areas	Floor areas only	Building structural components are not considered impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3012	North Side Utility Room and East Side Office Space	Floor areas only	Building structural components are not considered impacted since no radiological activities were conducted in the area during the license period of the Lead Cascade.
X-3012	North Side Mezzanine Utility Area	None	Flooring, equipment, and structural components are not considered impacted since this area is accessed from outside the facility, is not routinely occupied, and had no radiological activities conducted in the area during the license period of the Lead Cascade.
X-7725	Buffer Storage Area	Floor areas and centrifuge storage stands	Building structural components are not considered impacted since no radiological activities were conducted and no releases of radiological material occurred in the area during the license period of the Lead Cascade.
X-7725	Centrifuge Transporter Battery Room 161	Floor areas only	Building structural components are not considered impacted since no radiological activities were conducted and no releases of radiological material occurred in the area during the license period of the Lead Cascade.

Table IV.a-3 Summary of Impacted and Non-Impacted Areas Within Lead Cascade Facilities/Buildings

Building	Room/Area	Impacted	Non-Impacted
X-7725	Centrifuge Transporter Maintenance Room 162	Floor areas only	Building structural components are not considered impacted since no radiological activities were conducted and no releases of radiological material occurred in the area during the license period of the Lead Cascade.
X-7725	Storage Room 373	Floor areas only	Building structural components are not considered impacted since no radiological activities were conducted and no releases of radiological material occurred in the area during the license period of the Lead Cascade.
X-7725	Northwest Offices, Lunchroom, and Locker Rooms	Floor areas only	Building structural components are not considered impacted since no radiological activities were conducted and no releases of radiological material occurred in the area during the license period of the Lead Cascade.
X-7725	Northwest Utility and Ventilation Room	None	No items within this area are impacted since no radiological activities were conducted and no releases of radiological material occurred in the area during the license period of the Lead Cascade.
X-7725	Northeast Receiving Area	None	No items within this area are impacted since no radiological activities were conducted and no releases of radiological material occurred in the area during the license period of the Lead Cascade.
X-7726	First Floor	Floors, building structure up to 2 meters, installed equipment	Building structure above 2 meters are not considered impacted since no radiological activities were conducted and no releases of radiological material occurred in the area during the license period of the Lead Cascade.
X-7726	Assembly Stands (all levels)	All areas of the assembly stands including decking, remaining equipment, and tooling	None.
X-7726	Centrifuge Testing and Training Area	Floor areas only	Building structural components are not considered impacted since no radiological activities were conducted and no releases of radiological material occurred in the area during the license period of the Lead Cascade.

Table IV.a-3 Summary of Impacted and Non-Impacted Areas Within Lead Cascade Facilities/Buildings

Building	Room/Area	Impacted	Non-Impacted
X-7726	Ventilation Systems	Ventilations systems supplying the first floor and assembly stand areas	Ventilation systems associated with second and third floor offices are not considered impacted since these systems were not exposed to any radiological activity or release.
X-7726	Second and Third Floor Offices	Floor areas only	Building structural components and office equipment/furniture are not considered impacted since no radiological activities were conducted and no releases of radiological material occurred in the area during the license period of the Lead Cascade.
X-7727H	All	Floor areas only	Building structural components and office equipment/furniture are not considered impacted since no radiological activities were conducted and no releases of radiological material occurred in the area during the license period of the Lead Cascade.

☒ The mode of contamination for each surface (i.e., whether the radioactive material is present only on the surface of the material or if it has penetrated the material)

The two small areas of contaminated floor surface (concrete floor) within the X-3001 building North Utility Bay were decontaminated with a minimal amount of scarifing indicating that there was little penetration of the material. A 100 percent scanning survey was conducted post remediation and data confirms that contamination levels are less than Lead Cascade License limits (5,000 dpm/100 cm^2.)

☒ A scale drawing or map of the rooms or work areas showing the locations of radionuclide material contamination

Based on the 2015 Scoping Survey, Post Equipment Removal Surveys, and the Post Remediation Survey in X-3001 building, there is no reason to believe that any rooms or work areas are radiologically contaminated above the limits of 10 CFR Part 835, Appendix D.

IV.b. CONTAMINATED SYSTEMS AND EQUIPMENT

☒ A list or description and the location of all systems or equipment at the facility that contain residual radioactive material in excess of site background levels

☒ A summary of the radionuclides present in each system or on the equipment at each location, the maximum and average radionuclide activities in dpm/100cm^2, and, if multiple radionuclides are present, the radionuclide ratios

☒ The maximum and average radiation levels in mrem/hr at the surface of each piece of equipment

Contaminated equipment, components, and piping have been removed, packaged, and shipped for disposal at NNSS. It is for this reason that no information is included in this section.

The only measurable radiation levels at the Lead Cascade were found in UF_6 Model 12B cylinders. These cylinders were removed from the Lead Cascade during decommissioning activities and transferred to the Portsmouth Gaseous Diffusion Plant Decontamination and Decommissioning (DandD) contractor Fluor-BWXT Portsmouth LLC (FBP) on April 5, 2017. Typical general area radiation levels were <10 micro roentgens (μR)/hour.

☒ A summary of the background levels used during scoping or characterization surveys

Since the GCEP facilities were classified as radiological facilities, reference points were selected from the GCEP facilities or areas not impacted by Lead Cascade operations. The prime locations are the X-7725 building, X-3001 building Train 5, or the X-3002 building. Table IV.b-1 below shows the average count rates of the Lead Cascade areas.

Table IV.b-1 Background Levels

Location	Alpha Background (bkg)	Beta bkg	Average Alpha	Average Beta	Ambient bkg Counts Per Minute (cpm)	Surface bkg cpm
X-7725 Buffer Storage Col. D-5-31	5.6	142.8	7.1	180.0	148.4	187.1
X-3001 Train 5 Wall	6.0	142.0	11.1	114.4	148.0	125.5
X-3001 Train 6 Col. B-21	5.3	150.5	10.1	192.3	155.9	202.5
X-7725 Crane Stand	5.1	147.8	9.6	194.1	152.9	203.7

Reference point readings in Train 8 of the X-3002 building (which was not impacted by Lead Cascade operations or activities) were collected over a period of days. The study consisted of a series of five 1 minute background over several days with the instruments that will be used to perform the Final Status Survey. Since the survey will be evaluating different types of surfaces, this background study included wall, concrete floor, and a steel support beam readings. This will provide a consistent background for evaluating the Final Status Survey results. Table IV.b-2 below depicts the average count rates of the "reference points" for the X-3002 building. Table IV.b-3 below depicts the background readings for the floor monitor for the X-3002 building.

Table IV.b-2 Reference Points for the X-3002 Building

Ludlum 2224 counts/minute									
	Wall			Floor			Column		
260544	Alpha	Beta	Total	Alpha	Beta	Total	Alpha	Beta	Total
Average	2.5	138.5	141.0	3.1	243.7	246.8	2.8	126.7	129.5
Std Dev	1.6	13.4		1.9	16.1		1.5	11.2	
184192									
Average	3.2	115.5	118.7	3.3	232.7	236.0	2.6	102.4	104.9
Std Dev	1.8	11.4		1.6	17.2		2.0	9.7	

Table IV.b-3 Background Readings for the Floor Monitor for the X-3002 Building

Floor Monitor counts/minute		
Floor		
Alpha	Beta	Total
19.8	1,195.7	1,215.5
6.6	55.9	62.5

Each survey unit will include a minimum of five Reference Point readings for use with the Wilcoxon Rank Sum (WRS) Test discussed in Section XIV.d of this Decommissioning Plan.

☒ A scale drawing or map of the rooms or work areas showing the locations of the contaminated systems or equipment

Contaminated equipment, components, and piping has been removed, packaged, and shipped for permanent disposal at NNSS.

IV.c. SURFACE SOIL CONTAMINATION

☒ A list or description of all locations at the facility where surface soil contains residual radioactive material in excess of site background levels
☒ A summary of the background levels used during scoping or characterization surveys
☒ A summary of the radionuclides present at each location, the maximum and average radionuclide activities in pCi/gm, and, if multiple radionuclides are present, the radionuclide ratios
☒ The maximum and average radiation levels in mrem/hr at each location
☒ A scale drawing or map of the site showing the locations of radionuclide material contamination in surface soil

While the GCEP Lease does not require surface soil to meet the requirement of 10 CFR 20.1402, HP personnel have collected surface soil samples within the Lead Cascade footprint to determine the baseline radioactivity levels. This data indicates an average of 4.27 ± 2.32 picocurie (pCi)/g of alpha activity with a maximum value of 10.2 pCi/g. Based on this data, the 95 percent confidence level is estimated to be 8.8 pCi/g of alpha activity.

Table IV.c-1 Summary of Available Data

	PORTS Environmental Data		Lead Cascade Data
Analysis	**Off-site**	**Gaseous Diffusion Plant (GDP) Areas**	**GCEP Areas**
Average Uranium – microgram (μg)/g	3.0	4.6	N/A
Gross Alpha - pCi/g	7.0	10.9	4.3
Gross Beta - pCi/g	12.2	14.7	5.9

Note: Two sample locations from the GDP areas were deleted due to levels > 10 times the average. This allows a more realistic concentration not affected by outliers.

IV.d. SUBSURFACE SOIL CONTAMINATION

☒ A list or description of all locations at the facility where subsurface soil contains residual radioactive material in excess of site background levels
☒ A summary of the background levels used during scoping or characterization surveys
☒ A summary of the radionuclides present at each location, the maximum and average radionuclide activities in pCi/gm, and, if multiple radionuclides are present, the radionuclide ratios
☒ The depth of the subsurface soil contamination at each location
☒ A scale drawing or map of the site showing the locations of subsurface soil contamination

While the GCEP Lease does not require subsurface soil to meet the requirement of 10 CFR 20.1402, soil samples collected between 2005 and 2016 within the GCEP footprint (summarized in Table IV.c-1) indicated contamination levels indistinguishable from DOE reservation environmental data.

IV.e. SURFACE WATER

☒ A list or description of all surface water bodies at the facility that contain residual radioactive material in excess of site background levels
☒ A summary of the background levels used during scoping or characterization surveys
☒ A summary of the radionuclides present in each surface water body and the maximum and average radionuclide activities in becquerel per liter (Bq/L) (picocuries per liter (pCi/L))

There are no surface water bodies that contain residual radioactive material in excess of site background levels.

IV.f. GROUND WATER

☒ A summary of the aquifer(s) at the facility that contain residual radioactive material in excess of site background levels
☒ A summary of the background levels used during scoping or characterization surveys
☒ A summary of the radionuclides present in each aquifer and the maximum and average radionuclide activities in becquerel per liter (Bq/L) (picocuries per liter (pCi/L))

As stated within Section 9.2.2.4.5 of the License Application, due to historical operations, the site has multiple plumes of groundwater contamination. The primary contaminant in all of the plumes is the halogenated solvent trichloroethylene, but limited areas of technetium contamination also exist. Under the United States Enrichment Corporation Privatization Act, DOE is responsible for all pre-existing conditions at the site.

DOE is conducting a site-wide environmental remediation program under an Agreed Order with the State of Ohio. As part of this program, all site groundwater monitoring is under the control of DOE. Consequently, the Licensee does not propose to conduct additional groundwater monitoring as part of Lead Cascade operations.

V. DOSE MODELING

V.a. UNRESTRICTED RELEASE USING SCREENING CRITERIA

V.a.1. Unrestricted Release Using Screening Criteria for Building Surface Residual Radioactivity

☒ The general conceptual model (for both the source term and the building environment) of the site
☒ A summary of the screening method (i.e., running DandD or using the look-up tables) used in the DP

The Licensee was not able to use the screening criteria from NUREG-1757 because there are no screening values listed for Uranium in the look up tables. The *DandD* code was not able to be used to derive the screening levels because the Dose Conversion Factors used in *DandD* are for Class Y uranium rather than the Class D uranium present at the Lead Cascade.

V.a.2. Unrestricted Release Using Screening Criteria for Surface Soil Residual Radioactivity

☒ Justification on the appropriateness of using the screening approach (for both the source term and the environment) at the site
☒ A summary of the screening method (i.e., running DandD or using the look-up tables) used in the DP

While there is a NUREG-1757 screening criteria for residual uranium in surface soil, the surface soil around the Lead Cascade Facilities in not required to meet the requirements of 10 CFR 20.1402 thus this screening criteria was not used.

As stated within Section 9.2.2.4.2 of the License Application, between 1980 and 2009, annual gaseous uranium effluents have ranged from 0.97 Ci to 0.001 Ci. Soil and vegetation samples collected over this period showed that these levels of effluents do not produce a statistically significant difference in soil and vegetation concentrations in unrestricted areas. (Liquid effluents have no measurable impact on soil and terrestrial vegetation around the DOE reservation). Since the Lead Cascade contains less than 0.15 Ci of uranium and expects to release no more than 0.001 Ci/wk, soil and vegetation monitoring will not be useful in detecting a public impact due to gaseous effluents from the Lead Cascade.

Soil and vegetation monitoring is more likely to be useful in assessing the long-term impacts of routine effluents from DOE environmental remediation projects or in assessing the impact of unplanned releases. The DOE contractor maintains a soil and vegetation monitoring program for these purposes. As of 2015, the DOE program analyzes annual soil, vegetation, and crop samples for total uranium, uranium isotopes, technetium, and five transuranic isotopes. The results are available to the public in DOE's Annual Site Environmental Report.

However, it should be noted that there is no evidence of soil contamination resulting from Lead Cascade operations (reference Section IV.c. of this Decommissioning Plan). Additionally, there are no liquid operations, no permanent Contamination Areas, no instance of airborne radioactivity exceeding 0.1 percent of the Lead Cascade DAC, and no radiological work has been performed exterior to the X-3001 building, X-7726 facility, and X-3012 building. Surface soil samples collected annually in support of NRC Regulatory Guide 4.22, *Decommissioning Planning During Operations*, in the vicinities of Lead Cascade facilities are consistent with DOE reservation environmental sampling.

V.b. UNRESTRICTED RELEASE USING SITE-SPECIFIC INFORMATION

☒ Source term information including nuclides of interest, configuration of the source, and areal variability of the source
☒ Description of the exposure scenario including a description of the critical group
☒ Description of the conceptual model of the site including the source term, physical features important to modeling the transport pathways, and the critical group
☒ Identification/description of the mathematical model used (e.g., hand calculations, DandD Screen v1.0, and RESRAD v5.81)
☒ Description of the parameters used in the analysis
☒ Discussion about the effect of uncertainty on the results
☒ Input and output files or printouts, if a computer program was used

For the reasons mentioned in Section V.a.1 of this Decommissioning Plan, unrestricted release of Lead Cascade facilities using site specific information was deemed the most accurate method of determining release criteria. The *RESRAD-BUILD* v3.5 software package was utilized as the mathematical model for calculating dose. The *RESRAD-BUILD* software was chosen for dose modeling due to the fact that all radiological contamination has occurred internal to Lead Cascade facilities; therefore, post-decommissioning exposure would come from sources internal to Lead Cascade structures. The *RESRAD-BUILD* code is designed to evaluate the radiological doses to individuals who live or work inside a building that is contaminated with radioactive material. The dose calculation was based on the following assumptions:

- The Lead Cascade buildings/facilities would continue to be utilized as industrial facilities following decommissioning and therefore the dose model would be for that of full-time workers in an industrial setting
- The greatest exposure potential would be from a building occupancy scenario rather than building renovation/demolition scenario
- The occupancy time was based on an 8-hour work day, 5 days per week, and 50 weeks per year (assuming 2 weeks taken as vacation)
- The greatest exposure potential exists in the X-3001 building; therefore, a single room the size of the Train 2 Utility Bay was selected for the calculation
- Since there were only 2 discrete areas with minimal contamination in the X-3001 building, the source is assumed to be an area with contamination levels evenly distributed at the release limit
- The solubility of compounds of uranium encountered at the Lead Cascade are categorized as Class D (the most likely form will be UO_2F_2)

- The assay most likely to be present in residual contamination is that of naturally occurring uranium (0.72 percent) and is based on process knowledge relating to the Lead Cascade operating in the recycle mode

The default parameters in the *RESRAD-BUILD* software were utilized for the dose calculation with exception of the following:

- The building geometry was selected to be a single square room (Train 2 Utility Bay) with an area of 676.4 m^2 and a ceiling height of 2.5 m
- The source was selected as an area source, a circle with an area of 531.2 m^2 within the square room
- The Indoor Fraction selected was 0.23 and is the result of the occupancy assumption
- The dose conversion factor was changed to Class D
- Natural assay uranium (0.72 percent ^{235}U) was selected
- Evaluation times for 1, 10, 100, and 1,000 years were used
- Total alpha contamination of 5,000 dpm/100 cm^2

Figure V.b-1 below provides a screen shot of the RESRAD-BUILD parameters used for this dose calculation. Figure V.b-2 below is a screen shot of the resulting calculation from RESRAD-BUILD.

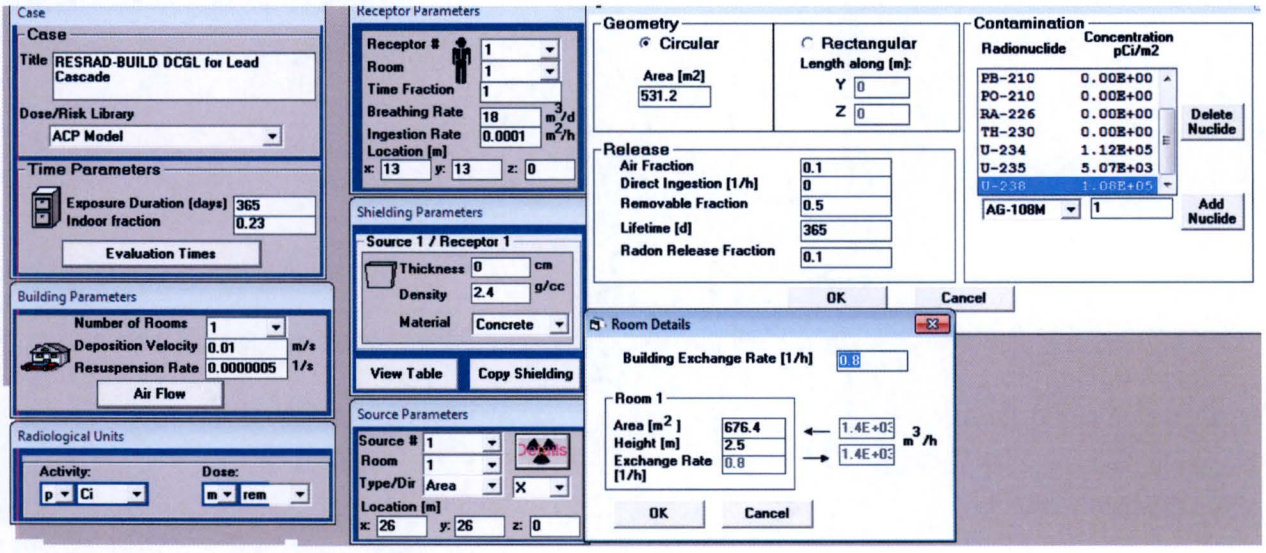
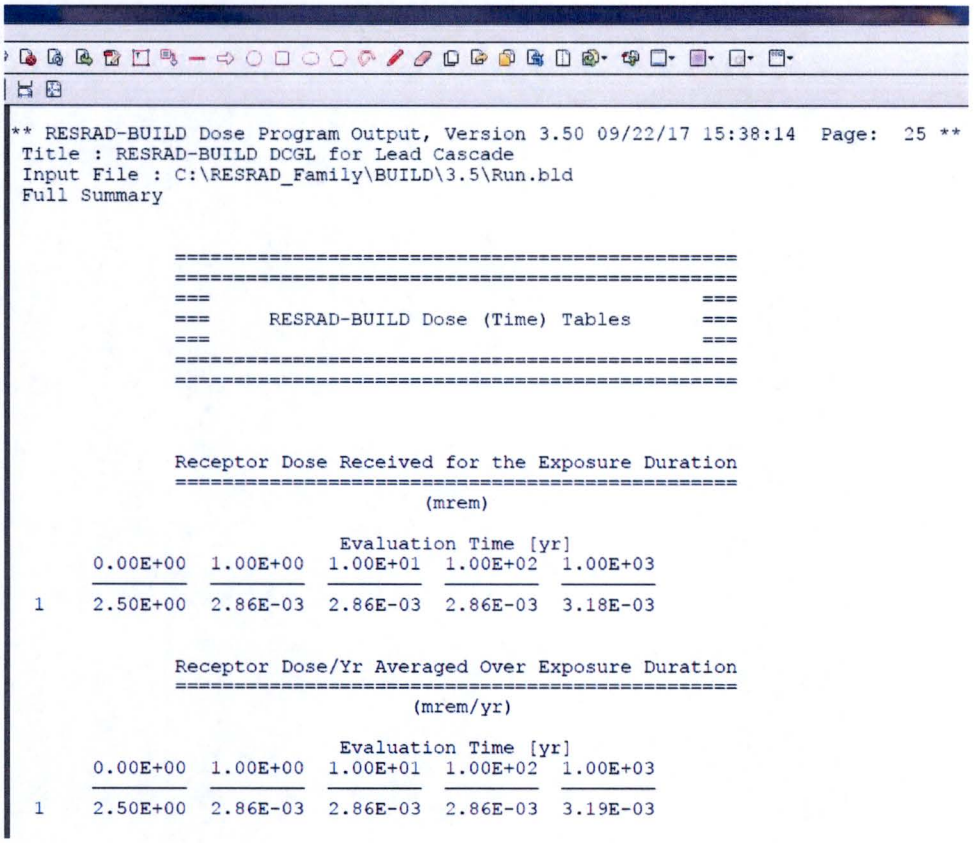


Figure V.b-1 Screen Shot Showing RESRAD-BUILD Parameters



```
** RESRAD-BUILD Dose Program Output, Version 3.50 09/22/17 15:38:14  Page:  25 **
 Title : RESRAD-BUILD DCGL for Lead Cascade
 Input File : C:\RESRAD_Family\BUILD\3.5\Run.bld
 Full Summary

            ================================================
            ================================================
            ===                                          ===
            ===     RESRAD-BUILD Dose (Time) Tables      ===
            ===                                          ===
            ================================================
            ================================================


            Receptor Dose Received for the Exposure Duration
            ================================================
                                  (mrem)

                              Evaluation Time [yr]
      0.00E+00  1.00E+00  1.00E+01  1.00E+02  1.00E+03
      --------  --------  --------  --------  --------
 1    2.50E+00  2.86E-03  2.86E-03  2.86E-03  3.18E-03


            Receptor Dose/Yr Averaged Over Exposure Duration
            ================================================
                                  (mrem/yr)

                              Evaluation Time [yr]
      0.00E+00  1.00E+00  1.00E+01  1.00E+02  1.00E+03
      --------  --------  --------  --------  --------
 1    2.50E+00  2.86E-03  2.86E-03  2.86E-03  3.19E-03
```

Figure V.b-2 RESRAD-BUILD Results

The *RESRAD-BUILD* results indicate nearly 100 percent of the projected dose is due to the uranium isotopes and the highest dose occurs in the first year. Since a concentration of uranium isotopes equal to 5,000 dpm/100cm^2 will cause a projected dose of 2.5 mrem, this ratio can be used to calculate the concentration that will cause a projected dose of 25 mrem ($DCGL_W$). Accordingly, the DCGLw is calculated using the Time 0 Dose (effectively the 1st years dose) in the following manner:

$$DCGL_W = \frac{5{,}000\ dpm/100cm^2}{2.5\ mrem}\ x\ 25\ mrem = 50{,}000\ \ dpm/cm^2$$

The resulting calculation establishes the DCGLw as 50,000 dpm/100 cm^2. While this value will meet the criteria from 10 CFR 20.1402 for unrestricted release, Chapter 4.0 of the Lead Cascade License Application Table 4.6-1 (cited below for reference) requires total contamination levels to be less than 5,000 dpm/100 cm^2 prior to releasing for unrestricted use. Therefore, the Licensee intends to use 5,000 dpm/100 cm^2 as the release criteria for the Final Status Survey contamination levels since it is more restrictive and consistent with ALARA practices.

Lead Cascade License Application Table 4.6-1 Contamination Levels

Nuclide[a]	Removable (dpm/100 cm^2)[b]	Total (Fixed + Removable) (dpm/100 cm^2)
U-natural, ^{235}U , ^{238}U, and associated decay products, Transuranics $\leq$ 2 percent by alpha activity, ^{99}Tc , and beta-gamma emitters	1,000	5,000
Transuranic modified materials containing > 2 percent and < 8 percent transuranics by alpha activity, Th-natural, ^{232}Th, ^{223}Ra, ^{224}Ra, and ^{232}U	200	1,000
^{226}Ra, ^{228} Ra, ^{230}Th, ^{228}Th, ^{231}Pa, ^{227}Ac, ^{125}I, ^{129}I, and Transuranics $\geq$ 8 percent by alpha activity	20	200

a. The values in this table apply to radioactive contamination deposited on, but not incorporated into the interior of, the contaminated item. Where contamination by both alpha and beta-gamma-emitting nuclides exists, the levels established for the alpha- and beta-gamma-emitting nuclides apply independently.

b. The amount of removable radioactive material per 100 square centimeters (cm^2) of surface area is determined by swiping the area with a dry filter or soft absorbent paper while applying moderate pressure and then assessing the amount of radioactive material on the swipe with an appropriate instrument of known efficiency. For objects with a surface area less than 100 cm^2, the entire surface is swiped; and the activity per unit area is based on the actual surface area. Except for transuranics $\geq$ 8 percent by alpha activity, ^{228}Ra, ^{227}Ac, ^{228}Th, ^{230}Th, ^{231}Pa, and alpha emitters, it is not necessary to use swiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual contamination is within the levels for removable contamination.

c. The levels may be averaged over one square meter provided the maximum surface activity in any area of 100 cm^2 is less than three times the level specified. For purposes of averaging, any square meter of surface is considered to be above the level G if: (1) from measurements of a representative number of n of sections it is determined that $1/n \, \Sigma_n \, S_i \geq G$, where S_i is the disintegration per minute (dpm)/100 cm^2 determined from measurements of section i; or (2) it is determined that the sum of the activity of all isolated spots or particles in any 100 cm^2 area exceeds 3G. (G is defined as the levels listed above.)

Additional evaluations were made to show the impact of varying several parameters within the model. Table V.b.1 below summarizes the calculations.

Table V.b-1 RESRAD-Build Results With Parameter Changes

Surface Contamination of 5,000/100 cm^2 of Natural Assay Uranium

Receptor Dose/Yr Averaged Over Exposure Duration					dpm/100 cm^2	
0	1	10	100	1,000	$DCGL_W$	Parameter settings*
2.50E+00	2.86E-03	2.86E-03	2.86E-03	3.19E-03	5.00E+04	RF=0.5; RR=5E-7; IF=0.23
7.87E-01	4.57E-03	4.57E-03	4.58E-03	5.10E-03	1.59E+05	RF=0.2; RR= 5E-5; IF=0.23
1.96E+00	2.86E-03	2.86E-03	2.86E-03	3.19E-03	6.38E+04	RF= 0.5; RR=5E-5; IF=0.23
1.71E+00	9.94E-03	9.94E-03	9.96E-03	1.11E-02	7.31E+04	RF=0.2; RR=5E-5; IF=0.5
5.45E+00	6.21E-03	6.21E-03	6.22E-03	6.92E-03	2.29E+04	RF=0.5; RR=5E-7; IF=0.5
1.01E+00	4.57E-03	4.57E-03	4.58E-03	5.10E-03	1.24E+05	RF= 0.2; RR=5E-7; IF=0.23
1.23E-01	5.54E-03	5.54E-03	5.55E-03	6.19E-03	1.02E+06	RF= 0.03; RR=5E-7; IF=0.23

*RR = Removable Fraction; RR = Resuspension Rate; IF = Indoor Fraction

The variance in DCGL from the selection of several assays was also determined with other parameters remaining fixed. Table V.b-2 summarizes the results of these calculations.

Review of the *RESRAD-BUILD* results indicates nearly 100 percent of the projected dose is due to the uranium isotopes and the highest dose occurs in the first year. The DCGLw is calculated using the Time 0 Dose (effectively the 1st years dose) in the following manner:

$$DCGL_W = \frac{5{,}000\ dpm/100cm^2}{2.5\ mrem}\ x\ 25\ mrem = 50{,}000\ \ dpm/cm^2$$

Table V.b-4 below shows the results for assays (percent ^{235}U) over the range of assays found in Lead Cascade HP sample data. *RESRAD-BUILD* results are summarized in the following Table:

Table V.b-2 Surface Contamination of 5,000/100 cm^2

RESRAD Parameters: Rem F = 0.5; Res Rate= 5E-7; Indoor Fraction 0.23

	Receptor Dose/Yr Averaged Over Exposure Duration					dpm/100 cm^2
% ^{235}U	0	1	10	100	1,000	$DCGL_W$
0.31%	2.46E+00	3.71E-03	3.72E-03	3.72E-03	3.90E-03	5.08E+04
0.71%	2.50E+00	2.86E-03	2.86E-03	2.86E-03	3.19E-03	5.00E+04
1.14%	2.53E+00	2.38E-03	2.38E-03	2.39E-03	2.78E-03	4.94E+04
1.40%	2.53E+00	2.28E-03	2.28E-03	2.28E-03	2.70E-03	4.94E+04
2.71%	2.56E+00	1.65E-03	1.65E-03	1.66E-03	2.16E-03	4.88E+04
3.28%	2.57E+00	1.63E-03	1.63E-03	1.64E-03	2.16E-03	4.86E+04
4.98%	2.57E+00	1.64E-03	1.64E-03	1.65E-03	2.19E-03	4.86E+04
					Average	4.94E+04

As shown above, the $DCGL_W$ does not vary significantly from the established $DCGL_W$ of 50,000 dpm/100 cm^2 when modifying various input parameters in RESRAD-BUILD. The most significant of these variability calculations resulted from increasing the Indoor Fraction from 0.23 to 0.5. It is not a likely scenario for an industrial worker.

Table V.b-2 above shows that a $DCGL_W$ of between 50,800 and 48,600 dpm/100 cm^2 of uranium alpha would meet the 10 CFR 20.1402 criteria for decommissioning for the range of assays encountered at the Lead Cascade. Therefore, the Licensee proposes using 50,000 dpm/100 cm^2 alpha as the $DCGL_W$.

However, this level of contamination (50,000 dpm/100 cm^2) do not meet commitments made in Chapter 4.0 of the License Application. Specifically, Table 4.8-1 of the License Application would require posting the area as a Fixed Contamination Area (see excerpt below).

Fixed Contamination [a]	Removable Contamination < Table 4.6-1 levels and total contamination levels > Table 4.6-1 column 3 values	"CAUTION, FIXED CONTAMINATION AREA"

[a] If the area has been sealed with contrasting fixatives or alternative methods and labeled in accordance with methods approved by the RPM, the area is exempt from posting as a Fixed Contamination Area.

Therefore, the Licensee proposes using 5,000 dpm/100 cm^2 as the basis for performing the Final Status Survey. This proposed value is currently being used in the performance of the "at-risk" Final Status Surveys at the Lead Cascade.

V.c. RESTRICTED RELEASE USING SITE-SPECIFIC INFORMATION

☒ Source term information including nuclides of interest, configuration of the source, areal variability of the source, and chemical forms
☒ A description of the exposure scenarios, including a description of the critical group for each scenario
☒ A description of the conceptual model(s) of the site that includes the source term, physical features important to modeling the transport pathways, and the critical group for each scenario
☒ Identification/description of the mathematical model(s) used (e.g., hand calculations and RESRAD v5.81)
☒ A summary of parameters used in the analysis
☒ A discussion about the effect of uncertainty on the results
☒ Input and output files or printouts, if a computer program was used

The Licensee is releasing the site for unrestricted use as described in Section V.b of this Decommissioning Plan; therefore, this section is not applicable.

V.d. RELEASE INVOLVING ALTERNATE CRITERIA

☒ Source term information including nuclides of interest, configuration of the source, areal variability of the source, and chemical forms
☒ A description of the exposure scenarios, including a description of the critical group for each scenario
☒ A description of the conceptual model(s) of the site that includes the source term, physical features important to modeling the transport pathways, and the critical group for each scenario
☒ Identification/description of the mathematical model(s) used (e.g., hand calculations and RESRAD v5.81)
☒ A summary of parameters used in the analysis
☒ A discussion about the effect of uncertainty on the results
☒ Input and output files or printouts, if a computer program was used

The Licensee is releasing the site for unrestricted use as described in Section V.b of this Decommissioning Plan; therefore, this section is not applicable.

VI. ENVIRONMENTAL INFORMATION

☒ Environmental information described in NUREG–1748

The Environmental Report (LA-2605-0002) was developed for the Lead Cascade during the initial licensing period and is organized in accordance with the guidance provided in NUREG-1748, *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs*. Consultations, as defined by Section 106 of the *National Historic Preservation Act* and Section 7 of the *Endangered Species Act*, are contained within Appendix B of the Environmental Report for the proposed action for the installation and operation of the Lead Cascade.

Section 3.5.4, Rare, Threatened, and Endangered Species, of the Environmental Assessment for the Lead Cascade states the following:

> *To comply with Section 7 of the Endangered Species Act, the U.S. Fish and Wildlife Service (USFWS) was contacted to determine if any Federally endangered species may be found at the site. According to the USFWS, the Indiana bat (Myotis sodalis) is the only Federally listed endangered animal species whose home range includes the site. Surveys at the reservation revealed no Indiana bats at the site. The Ohio Department of Natural Resources (ODNR) was also contacted, and the ODNR indicates no records of rare or endangered species within the project area.*

Section 3.8, Historic and Cultural Resources, of the Environmental Assessment for the Lead Cascade states the following:

> *Historic and cultural resources are evaluated because of NEPA requirements and Section 106 of the National Historic Preservation Act, which protect historic properties from potential adverse impacts resulting from Federal agency actions. Historic, archaeological, and traditional cultural resources should be analyzed in sufficient detail to provide the basis for subsequent analysis and assessment of possible impacts. Adverse effects consist of any action that would diminish the property's location, design, setting, materials, workmanship, feeling, or association. If these resources are found to be impacted, then measures may need to be taken to avoid, minimize, or mitigate any adverse effects as required by 36 CFR Part 800.*
>
> *PORTS is located within a region where Adena and Hopewell Indian mounds have existed. Additionally, several historic Native American Indian tribes are known to have had villages nearby. Upon being contacted regarding this Environmental Assessment, the Ohio State Historic Preservation Office (SHPO) stated that the SHPO made a finding of no adverse effect for the Lead Cascade. Further, the SHPO stated that the proposed action meets the National Register Criteria for Evaluation (NRCE) (36 CFR 60.4) Criterion A because of the site's significance in the development of nuclear energy potential in post-World War II U.S. history. Criterion A identifies properties that are associated with events that have a significant contribution to U.S. history. Cultural resources are defined as any prehistoric or historic district, site, building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reason. When these resources meet anyone of the NRCE, they may be termed historic properties and are potentially eligible for inclusion on the National Register of Historic Places. Thus, PORTS may be considered for addition to the National Register at some point in the future.*

More recently, on June 22, 2017, the NRC issued the Final Environmental Assessment for the Approval to Transport Classified Matter and Wastes for Disposal for the Lead Cascade in Piketon, Ohio (Docket Number 70-7003). The NRC staff evaluated the potential environmental impacts associated with the proposed action and the no-action alternative, and has documented the results of the assessment in their Final Environmental Assessment. The NRC staff performed this review in accordance with the requirements of 10 CFR Part 51 and applicable staff guidance found in NUREG-1748. The NRC reviewed relevant information in documents submitted by the Licensee as well as NRC's previous Environmental Assessment for the licensing of the Lead Cascade. This Final Environmental Assessment stated the following:

> *Although there are several environmentally sensitive areas within the larger DOE site, the areas occupied by the Lead Cascade are either inside an existing concrete-floored building or are located on paved surfaces that are not in proximity to these environmentally sensitive areas. As discussed earlier, all planned packaging and*

preparation for shipping activities would occur within the existing leased facilities, and no new construction or land disturbances is expected.

Environmental monitoring for both radiological and chemical components is required by State and Federal regulations and/or permits. There were no spills during Lead Cascade Facility operations wherein radioactive material contaminated local ground water supplies. Currently at the Lead Cascade Facility there are no liquid operations, permanent contamination areas or instances of airborne radioactivity exceeding 0.1 percent of the Lead Cascade Facility derived air concentrations set at 1 x 10^{-10} micro Curie per millimeter. No radiological work was performed outside the facility buildings, and here is no evidence of soil contamination attributable to the Lead Cascade Facility.

Prior to the NRC's issuance of License Number SNM-7003 for the Lead Cascade in 2004, the Ohio State Historic Preservation Officer (Ohio SHPO) in 2003 made a finding that the licensing action would have no adverse effect on historic properties. The Ohio SHPO stated that the Lead Cascade licensing action met the National Register Criteria for Evaluation (36 CFR 60.4) Criterion A because of the site's previous significance in the development of nuclear energy potential in post-World War II U.S. history. For the present action, the NRC staff again consulted with the Ohio SHPO. The Ohio SHPO responded by letter dated May 8, 2017, stating that a finding of No Adverse Effect for the proposed action is appropriate. The Ohio SHPO also stated that during future decommissioning activities further consultation under Section 106 of the National Historic Preservation Act would be necessary.

In accordance with the requirements in 10 CFR Part 51, the NRC staff has concluded that the proposed action will not significantly affect the quality of the human environment. As discussed in this Final Environmental Assessment, no significant radiological or non-radiological impacts are expected to result from approval of the proposed action. Occupational dose estimates associated with the proposed action are expected to be ALARA and within the limits of 10 CFR 20.1201. Approval of the proposed action is not expected to result in measurable radiation exposure to a member of the public. Therefore, the NRC staff has determined that pursuant to 10 CFR 51.31, preparation of an environmental impact statement is not required for this proposed action, and pursuant to 10 CFR 51.32, a "finding of no significant impact is appropriate".

On November 7, 2017 (ACO 17-0048), the Licensee provided a status of the decommissioning activities at the Lead Cascade to the Ohio State Historic Preservation Office in an effort to confirm that the decommissioning activities continue to have no effect on the historic nature of the PORTS reservation. To date, no response has been received.

The Licensee is requesting an exclusion from an Environmental Assessment for the Decommissioning Plan under category 11 of 10 CFR 51.22 for the following reasons:

Section 3.2 of the GCEP Lease makes the Corporation responsible for removal and/or disposal of all radiological contamination and for the disposal of all Leased Personalty described in Exhibit B at the end of the Personality's useful life. Additionally, this section requires the Corporation to obtain the Department's written approval of a Disposition Plan appropriate to the sensitivity of the material proposed for disposal. Pursuant to these requirements, the Licensee submitted and DOE has approved a disposition plan for classified and radiologically contaminated property which provides for disassembly of Lead Cascade equipment, packaging for shipment, and transportation of the equipment to NNSS for burial. All of this activity is being conducted in accordance with approved Licensee programs and procedures developed under the NRC approved Lead Cascade License. Any changes needed to accommodate special circumstances have been screened for unresolved safety questions and none were identified.

The Licensee will finish dispositioning classified and radiologically contaminated property from the Lead Cascade by the end of 2017. After this equipment is dispositioned and the areas in which licensed radioactive material was used or stored are clear enough to be surveyed for radiological contamination, the Licensee intends to follow approved radiological control programs and procedures to ascertain if remediation is needed to meet section 4.3(c) of the GCEP Lease which states: Prior to returning the GCEP Leased Facilities, the Corporation will comply with the following criteria: (1) for radiological contamination, the GCEP Leased facility shall be returned in a condition that meets NRC's radiological criteria for unrestricted use in 10 CFR 20.1402. Preliminary radiological surveys indicated two small areas needed remediation which has been completed using approved decontamination procedures.

Since programs and procedures developed under the NRC license for the Lead Cascade have or will be used to establish conditions needed to design and execute the Final Site Survey, the amendment to the Lead Cascade License Application establishing a detailed decommissioning plan essentially becomes administrative, organizational or procedural in nature as discussed in category 11 of 10 CFR 51.22. However, certain conditions must be met for the NRC to approve this exclusion. These provisions and the Licensee's evaluation of each one is as follows:

i. Significant change in the types or significant increase in the amounts of any effluents that may be released off site

   The types and amounts of effluents released off-site is discussed in Chapter 9.0 of the License application. There are no significant changes to these effluents caused by decommissioning other than a reduction in radionuclides released from the PV and EV vent in X-3001 building since these systems are no longer operational. Of note, releases from the disassembly of centrifuge machines in X-7726 facility are captured by an engineered system designed for this purpose, thus increasing the rate of disassembly, as is the case during decommissioning, will not increase the release to the environment.

ii. Significant increase in individual or cumulative occupational radiation exposure

Occupational exposure is discussed in Chapter 4.0 of the License Application. With respect to occupational exposure of individuals, external exposure to the workforce is expected to be less during decommissioning since cylinders containing licensed material were transferred to DOE as part of this decommissioning. Additionally, internal exposure from disassembly of centrifuge machines and packaging them for shipment has been reduced by pretreating these machines with wet air before disassembly. Additionally, as discussed in i. above, engineered systems are in place to capture any releases that may happen during disassembly. With respect to cumulative occupational exposure, it will decrease during decommissioning because the size of the work force has decreased.

iii. Significant construction impact

Decommissioning does not involve any construction either inside of the GCEP Leased Facilities or outside. Chapter 10.0 of the License Application discusses the possibility of constructing a centrifuge disassembly stand in the X-3001 building, but this option was never exercised. Rather, the existing test stands in X-7726 building were utilized for this purpose.

iv. Increase in the potential for or consequences from radiological accidents

Emergency Management is discussed in Chapter 8.0 of the License Application. This Chapter documents that the cascade feed cylinder located in the X-3001 building is the principle source for nearly all of the accident scenarios in the Lead Cascade. As discussed in sub-section ii. above, this cylinder has been transferred to DOE.

For the reasons above, the Licensee believes the exclusion under 10 CFR 51.22(c)(11) is justified.

☒ For an EIS, the environmental information is reviewed by the EPAD EIS project manager

During the initial licensing process of the Lead Cascade, the NRC prepared an Environmental Assessment in response to the License Application (Docket Number 70-7003) submitted by USEC Inc., in February 2003 for the construction of the Lead Cascade, a test and demonstration facility designed to provide information on the American Centrifuge technology. As made effective within Amendment 7 of the NRC Materials License (SNM-7003) the direct transfer of the NRC Materials License SNM-7003 from USEC Inc. to ACO (the Licensee) became effective February 8, 2013. The Licensee's proposal was to construct, operate, and decommission this facility within existing facilities at the DOE reservation located in Piketon, Ohio. On the basis of the assessment, the NRC staff concluded that environmental impacts associated with the proposed action would not be significant and did not warrant the preparation of an environmental impact statement. Accordingly, it was determined that a "Finding of No Significant Impact" was appropriate.

Additionally, during the initial licensing process of the ACP, the NRC prepared an Environmental Impact Statement (NUREG-1834) in response to the license application (Docket Number 70-7004)

submitted by the USEC Inc., in August 2004 for the construction, manufacturing, start-up, operations, maintenance, and decommissioning of a uranium enrichment facility using American Centrifuge technology that will produce approximately 3.8 million separative work units annually, which ultimately resulted in the issuance of NRC Materials License (SNM-2011) for the ACP. As made effective within Amendment 3 of the NRC Materials License (SNM-2011) the direct transfer of the NRC Materials License SNM-2011 from USEC Inc. to the Licensee became effective February 8, 2013. In the Environmental Impact Statement, the NRC staff concluded that there would be only a small impact during decontamination and decommissioning activities for this uranium enrichment facility since the transportation aspects of the decommissioning activities would require less truck shipments for offsite disposal compared to the anticipated truck traffic for site preparation and construction period.

VII. ALARA ANALYSIS

☒ A description of how the licensee will achieve a decommissioning goal below the dose limit

ALARA Decommissioning Goal

As discussed in Section I of this Decommissioning Plan, the 5,000 dpm/100 cm^2 the Licensee will use as the contamination limit for the Final Status Survey is only one tenth of the 50,000 dpm/100 cm^2 calculated DCGLw. This conservatism meets ALARA considerations required by 10 CFR 20.1402.

Worker Radiological Impacts of Waste Packaging During Decommissioning Efforts

Based on latest Licensee dosimetry data, personnel doses at the Lead Cascade were consistently less than 100 mrem/year Total Effective Dose Equivalent (TEDE). The RP program outlined in Chapter 4.0 of the License Application was constructed to protect personnel entering the Lead Cascade buildings/facilities from unnecessary exposure to ionizing radiation and radioactive materials. This program is based upon the following principles and is implemented through currently approved operating procedures.

- Personnel radiation exposures and the release of radioactive effluents shall be maintained in accordance with the ALARA principle.
- No individual shall receive a radiation dose in excess of any regulatory limit.
- The established personnel monitoring program objectives are:
  - < 500 mrem per year TEDE per person
  - < 10 milligram (mg) per week soluble uranium

Specifically, a review of Fixed Nuclear Accident Dosimeters (FNAD) and area monitoring Thermoluminescence Dosimeters (TLD) data indicates radiation levels at the Feed Cart have been 0.012 mrem/hour; while all other FNADs and area monitors indicated <0.001 mrem/hour. Recent surveys indicate background at the Lead Cascade is approximately 0.006 mR/hour; prior to

cylinder removal at the Feed Cart levels were 0.04 mR/hour. Elsewhere in the X-3001 building Train 3 area average levels were in the 0.008 to 0.010 mR/hour range. Levels in the X-7726 facility are typically < 0.01 mR/hour.

The estimated dose rate from 1 kg of natural uranium is $4x10^{-5}$ rem/hour (0.04 mrem/hour) at 30 cm. Since Lead Cascade items are relatively large compared to a point source and there are no individual components or pieces expected to contain or exceed 1 kg of material, special dose monitoring is not required.

Chapter 4.0 of the License Application defines restricted areas as areas to which access is limited by the Licensee to protect individuals against undue risk from exposure to radiation and radioactive materials. Personnel working in restricted areas (RMA or higher level of posting) are required to be monitored with a National Voluntary Laboratory Accreditation Program (NVLAP) accredited TLD. This is consistent with the requirements of the Dosimetry Program procedures. Since decommissioning activities were performed in areas posted as an RMA, no changes to current practices were warranted. As of November 2017, based upon completed HP surveys, the X-7727H corridor, X-3001 building corridor, and portions of the X-7725 building Buffer Storage Area have been down posted from an RMA. TLDs are no longer required in these down posted areas.

Due to the small amount of material within the Lead Cascade equipment, personnel external doses are expected to remain less than 100 mrem/year. The RP requirements used during decommissioning are the same requirements currently implemented at the Lead Cascade. The program elements were developed to ensure worker radiological safety with the risks associated with the hazards at the Lead Cascade. These requirements are implemented by currently approved operating procedures developed in accordance with the requirements of Section 11.4 of the License Application.

[See Appendix C of this Decommissioning Plan for the public radiological impacts of waste shipments to NNSS during the Lead Cascade decommissioning activities.]

☒ A quantitative cost benefit analysis
☒ A description of how costs were estimated
☒ A demonstration that the doses to the average member of the critical group are ALARA

Using the currently approved operating procedures, personnel doses have been maintained significantly less than the annual Lead Cascade ALARA goals of 100 mrem/year TEDE and intakes less than 1 mg/week. Since decommissioning activities will be performed using these same RP operating procedures, a quantitative cost benefit analysis is not considered necessary.

VIII. PLANNED DECOMMISSIONING ACTIVITIES

VIII.a. CONTAMINATED STRUCTURES

☒ A summary of the remediation tasks planned for each room or area in the contaminated structure, in the order in which they will occur

All required decontamination has been completed.

☒ A description of the remediation techniques that will be employed in each room or area of the contaminated structure

☒ A summary of the radiation protection methods and control procedures that will be employed in each room or area

The contaminated areas in X-3001 building were decontaminated using a combination of wet and dry techniques; however, minor scarifying of these concrete surfaces was required to reduce contamination to levels less than license limits. Work during decontamination was performed with continuous HP coverage. Scarifying was performed under an RWP with dust collection to minimize personnel exposure and debris was collected, packaged, and shipped for disposal.

☒ A summary of the procedures already authorized under the existing license and those for which approval is being requested in the DP

As described in Section 4.4.1 of the License Application, the RP program is implemented using currently approved operating procedures. The procedures are prepared consistent with the requirements of 10 CFR Part 20 and are approved, maintained, and adhered to for operations/activities involving personnel radiation exposure and toxicological exposure to soluble uranium. The procedures are reviewed and revised as necessary to incorporate any facility or operational changes, including those initiated by changes to the ISA. These procedures are prepared, maintained, and made available to appropriate personnel at the facility as described in Section 11.4 of the License Application. Currently approved procedures will minimize worker exposure and waste volumes, and assure work is carried out in a safe manner. There are no additional procedures for which approval is being requested.

☒ A commitment to conduct decommissioning activities in accordance with written, approved procedures

The Licensee commits to conducting decommissioning activities in accordance with approved programs, plans, and procedures. As described in Section 11.4 of the License Application, a management controls program has been established for the development, issuance, and control of procedures. At a minimum, procedures are required to ensure safe work practices that control processes and operations with special nuclear material and/or hazardous chemicals incident to the processing of licensed material. Procedures unrelated to nuclear safety, safeguards, and security, and do not involve or impact Lead Cascade operations as described in the ISA Summary, are not

governed by the requirements of Section 11.4 of the License Application. Section 11.4.8 of the License Application provides a listing of topics covered in procedures.

☒ A summary of any unique safety or remediation issues associated with remediating the room or area

All required decontamination has been completed.

☒ For Part 70 licensees, a summary of how the licensee will ensure the risks addressed in the facility's Integrated Safety Analysis will be addressed during decommissioning

An engineering evaluation (EE-2901-0020) was performed to determine which Lead Cascade items relied on for safety (IROFS) are applicable during decommissioning activities or if any new IROFS are needed. This evaluation concluded that no new IROFS were required during decommissioning activities as all of the risks during decommissioning activities are adequately bounded by existing ISA events. However, there were some ISA events which could remain credible during initial decommissioning activities, so any IROFS associated with those events were maintained.

Five IROFS were determined to be unnecessary once the Lead Cascade was shut down and de-inventoried. Once the releasable UF_6 inventory was consolidated into a single cylinder and moved to an appropriate area with minimal interaction with decommissioning activities and still had fire suppression system coverage, six more IROFS became unnecessary. The consolidated cylinder containing the releasable UF_6 inventory was removed from the Lead Cascade MBA on April 5, 2017; therefore, the remaining 26 IROFS were no longer required to meet the performance requirements and were stood down. Additionally, restrictions on activities that were not previously analyzed in the ISA/ISA Summary are no longer required.

The remaining licensed material could not be released by any credible event which would result in consequences that could exceed the performance requirements per 10 CFR 70.61. The remaining licensed material was holdup of licensed material which adhered to the process equipment and piping interior surfaces. When this contaminated equipment was removed, packaged, and sent to NNSS, this holdup went with it.

VIII.b. CONTAMINATED SYSTEMS AND EQUIPMENT

- ☒ A summary of the remediation tasks planned for each system in the order in which they will occur, including which activities will be conducted by licensee staff and which will be performed by a contractor
- ☒ A description of the techniques that will be employed to remediate each system in the facility or site
- ☒ A description of the radiation protection methods and control procedures that will be employed while remediating each system
- ☒ A summary of the equipment that will be removed or decontaminated and how the decontamination will be accomplished
- ☒ A summary of the procedures already authorized under the existing license and those for which approval is being requested in the DP
- ☒ A commitment to conduct decommissioning activities in accordance with written, approved procedures

The classified and/or contaminated equipment has been removed from the Lead Cascade and dispositioned in accordance with Security Plan SP-3605-0030, *Disposition Plan for American Centrifuge Program Classified/Contaminated Property at the U.S. Department of Energy Nevada National Security Site (NNSS)*.

The majority of the centrifuges were operated on UF_6 gas for Lead Cascade demonstration and testing purposes. A total of 291 centrifuges have been properly disposed at NNSS. In addition to associated service modules and interconnecting piping, decommissioning of the Lead Cascade also required dispositioning the associated spare parts inventory, manufacturing equipment, and other parts and equipment stored in the Lead Cascade.

Lead Cascade decommissioning has been jointly performed by ACO and an NNSS-approved waste contractor for package certification and shipment of classified and/or contaminated material. ACO selected EnergySolutions, LLC (EnergySolutions) to fill this role. ACO removed and packaged wastes for disposal in compliance with currently approved procedures, applicable laws, and regulations. The NNSS-approved contractor certified that the waste was packaged in accordance with the NNSS Waste Acceptance Criteria (WAC). ACO and EnergySolutions ensured packaged waste was shipped in accordance with a NRC-approved transportation security plan.

A limited amount of the generated waste was considered Low-Level Mixed Waste (LLMW) and as such required special treatment (macro encapsulation) before burial at NNSS. ACO contracted EnergySolutions to perform this special treatment. This facility holds a DOE possessing facility clearance and the associated site security plan protects classified material sent to the site by various generators throughout the DOE complex. This LLMW was shipped from Piketon, Ohio, to Oak Ridge, Tennessee, for treatment, repackaged in accordance with EnergySolutions procedures, and then continued shipment to NNSS for permanent burial.

From a project standpoint, classified and/or contaminated material was divided into three groups for convenience. These groups were centrifuges, service modules, and the balance of plant equipment. With a few exceptions, the disposal of classified and/or contaminated material was executed in a fashion similar to the GCEP Cleanup project that transpired in the 2004 timeframe.

The centrifuges were stored in the X-3001 building and in the X-7725 building leased by ACO under the GCEP Lease. Currently approved ACO procedures were used to transfer these centrifuges to the X-7726 facility for disassembly and prepare them for packaging. These currently approved procedures also provided guidance for tracking configuration changes, staging subcomponents for eventual packaging, and security controls required during each phase of this activity. Completed centrifuge waste containers were stored in the X-7725 building Buffer Storage Area as well as the X-7727H corridor awaiting final loading for shipment to NNSS.

Service modules were partially disassembled to reduce the weight of the unit. Components removed from the service module included various centrifuge control components and other electrical equipment, ventilation ductwork, as well as some Machine Isolation Valves (MIV). The remainder of the service module was sectionalized to facilitate packaging in Intermodal Freight Transport (IFT) or B-25 containers. Access control measures in the X-3001 building during decommissioning of the Lead Cascade are established in NRC-approved NR-3605-0004, *Security Program for the American Centrifuge Plant*, and Security Plan SP-3605-0033, *Classified Material Storage Within The X-3001 Process Building*.

The balance of classified and/or contaminated equipment (centrifuge support systems, spare components, computer network equipment, and miscellaneous materials) were placed in B-25 or IFT containers and shipped to NNSS for permanent burial.

On April 5, 2017, all thirty-seven Model 12B cylinders, including UF_6 contents, were transferred to the Portsmouth Gaseous Diffusion Plant DandD contractor (FBP).

Classified documents are either being destroyed in accordance with applicable currently approved security procedures, or packaged and shipped to an approved location for storage in accordance with applicable currently approved security programs/plans and procedures. DOE and NRC security staff visited the Lead Cascade on November 28, 2017. Plans are underway to complete the security closeout surveys in January 2018 followed by issuance of a Certificate of Non-Possession to NRC. A Non-Possessing Security Plan will then be implemented by ACO to handle the controlled, unclassified information categories that remain at the facility.

☒ A summary of any unique safety or remediation issues associated with remediating any system or piece of equipment

There was no remediation of contaminated Lead Cascade equipment; therefore, this section is not applicable.

☒ For Part 70 licensees, a summary of how the licensee will ensure that the risks addressed in the facility's Integrated Safety Analysis will be addressed during decommissioning

See Section VIII.a of this Decommissioning Plan for this discussion.

VIII.c. SOIL

☒ A summary of the removal/remediation tasks planned for surface and subsurface soil at the site in the order in which they will occur, including which activities will be conducted by licensee staff and which will be performed by a contractor
☒ A description the techniques that will be employed to remove or remediate surface and subsurface soil at the site
☒ A description of the radiation protection methods and control procedures that will be employed during soil removal/remediation
☒ A summary of the procedures already authorized under the existing license and those for which approval is being requested in the DP
☒ A commitment to conduct decommissioning activities in accordance with written, approved procedures
☒ A summary of any unique safety or removal/remediation issues associated with remediating the soil
☒ For Part 70 licensees, a summary of how the licensee will ensure that the risks addressed in the facility's Integrated Safety Analysis will be addressed during decommissioning

No remediation tasks are necessary for surface and subsurface soil for reasons discussed in section V.a.2 of this Decommissioning Plan.

VIII.d. SURFACE AND GROUND WATER

☒ A summary of the remediation tasks planned for ground and surface water in the order in which they will occur, including which activities will be conducted by licensee staff and which will be performed by a contractor
☒ A description of the remediation techniques that will be employed to remediate the ground or surface water
☒ A description of the radiation protection methods and control procedures that will be employed during ground or surface water remediation
☒ A summary of the procedures already authorized under the existing license and those for which approval is being requested in the DP
☒ A commitment to conduct decommissioning activities in accordance with written, approved procedures
☒ A summary of any unique safety or remediation issues associated with remediating the ground or surface water

No remediation tasks are necessary for surface and ground water for reasons discussed in section V.a.3 of this Decommissioning Plan.

VIII.e. SCHEDULES

☒ A Gantt or PERT chart detailing the proposed remediation tasks in the order in which they will occur

See Figure VIII.e-1 within Appendix D of this Decommissioning Plan for the high level detail pertaining to the remaining decommissioning activities for the Lead Cascade. The Licensee understands that final termination of the Lead Cascade NRC Materials License is contingent on NRC approval of the Decommissioning Plan, which includes the remaining decommissioning schedule.

☒ A statement acknowledging that the dates in the schedule are contingent upon NRC approval of the DP

Decommissioning activities, with the exception of the Final Status Survey, will have been completed within the bounds of the License Application before NRC approval of the Decommissioning Plan. Changes to current activities or procedures are evaluated using 10 CFR 70.72 to determine if prior NRC approval is required. It is the Licensee's intention to immediately request termination of the Lead Cascade License upon approval of the Decommissioning Plan and the Final Status Survey Report. The Licensee, therefore, requests that the Lead Cascade License remain in place until license termination.

Additionally, using 5,000 dpm/100 cm^2 as the Final Status Survey limit is consistent with the commitments stated in the currently approved License Application; therefore, remediation work activities have been performed under current Lead Cascade programs. The Licensee acknowledges remediation work or validation surveys done before NRC approval of this Decommissioning Plan are done "at risk" and may have to be repeated at the Licensee's expense if the proposed DCGL is not accepted.

☒ A statement acknowledging that circumstances can change during decommissioning, and, if the licensee determines that the decommissioning cannot be completed as outlined in the schedule, the licensee will provide an updated schedule to NRC

The Licensee acknowledges that circumstances can change during decommissioning and if it is determined that the decommissioning effort cannot be completed as outlined within the schedule provided in Figure VIII.e-1 of this Decommissioning Plan (Appendix D), the Licensee will provide an updated schedule to the NRC. The Final Radiation Survey tasks are currently being performed "at-risk" and security close-out is planned for January 2018 to allow the Licensee to request termination of the NRC Materials License at the end of the first quarter 2018. The Licensee understands that final termination of the Lead Cascade NRC Materials License is contingent on NRC approval of the Decommissioning Plan. However, the Licensee does not foresee any impacts that would cause a shift in the decommissioning schedule for completion.

☒ If the decommissioning is not expected to be completed within the timeframes outlined in NRC regulations [i.e., 10 CFR 30.36(h)(1), 10 CFR 40.42(h)(1), 70.38(h)(1), or 72.54(j)(1)], a request for alternative schedule for completing the decommissioning.

The Licensee is confident that decommissioning activities will be completed well within the timeframes outlined within 10 CFR 70.38(h) (i.e., within 24 months after NRC approval of this Decommissioning Plan). Should these circumstances change at any time during the decommissioning efforts, the Licensee will provide the appropriate notification to the NRC in accordance with 10 CFR 70.38(f).

IX. PROJECT MANAGEMENT AND ORGANIZATION

IX.a. DECOMMISSIONING MANAGEMENT ORGANIZATION

☒ A description of the decommissioning organization
☒ A description of the responsibilities of each of these decommissioning project units
☒ A description of the reporting hierarchy within the decommissioning project management organization
☒ A description of the responsibility and authority of each unit to ensure that decommissioning activities are conducted in a safe manner and in accordance with approved written procedures

Figure IX.a-1 below provides the decommissioning organizational structure with further management responsibilities, authorities, and reporting hierarchy discussed within Chapter 2.0 of the License Application.

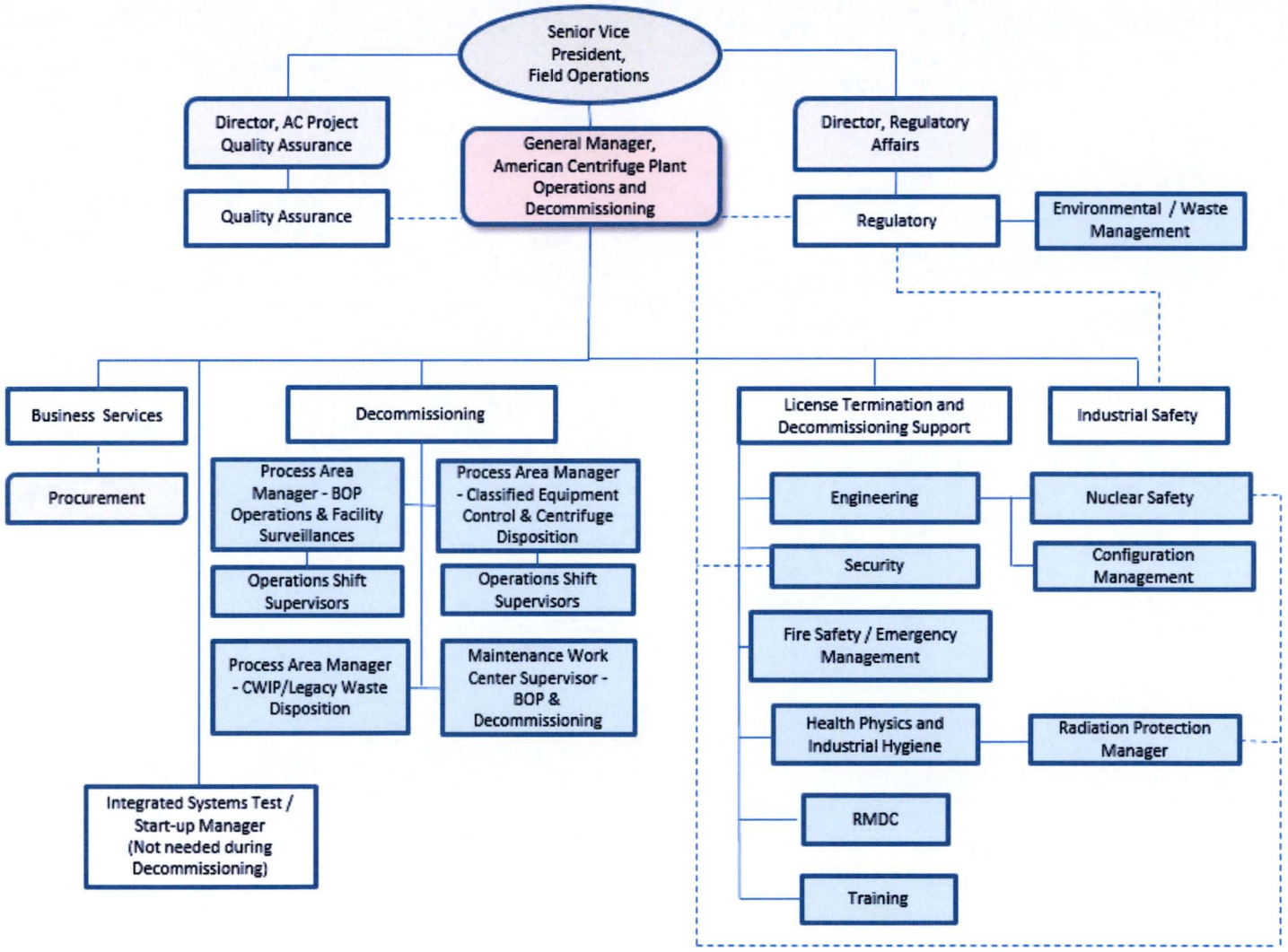


Figure IX.a-1 Decommissioning Organizational Structure

IX.b. DECOMMISSIONING TASK MANAGEMENT

☒ A description of the manner in which the decommissioning tasks are managed

Decommissioning tasks have been performed in accordance with approved operating programs and processes that are compliant with license requirements. New tasks and changes to existing tasks are evaluated in accordance with an approved Change Evaluation process to ensure all license requirements are maintained. Radiological specific tasks are performed in accordance with the RP program. The RP program addresses the occupational RP requirements set forth in 10 CFR Parts 19, 20, and 70. The Lead Cascade program for minimizing and monitoring doses to the public and the environment are discussed in Chapter 9.0 of the License Application.

☒ A description of how individual decommissioning tasks are evaluated and how the Radiation Work Permits (RWPs) are developed for each task

A Radiological Review evaluates the requirements for surveys, personal protective equipment (PPE), posting of work areas, special monitoring, handling components, etc. Additionally, this review evaluates prior survey data to determine acceptable actions to maintain exposures ALARA. The Radiological Review evaluated the use of current RWPs for decommissioning related tasks and new tasks were developed as necessary.

Contaminated equipment was removed for disposal at NNSS. The bulk of the residual contamination [See Appendix C of this Decommissioning Plan for additional information] was contained in the centrifuge machines. The remainder was on the interior of cascade piping, valves, pumps, etc. For worker protection, current RWPs were evaluated and new tasks were developed as necessary.

The centrifuge machines had inventory removed and were backfilled with nitrogen or dry air to minimize exposure potential during opening. Previous work on rebuild of centrifuge machines indicates HF is the primary concern; thus, as required, respiratory protection was provided during various openings of the centrifuge machines. Removable contamination levels are between 1 and 100 times free release limits, depending on the component being surveyed.

Selected machine components contained oil that was removed prior to packaging for disposal. The centrifuge casing was used as the waste disposal shipping container. [See Appendix C of this Decommissioning Plan for additional information] The tasks for preparing centrifuge machines for disposal are similar to rebuilding centrifuge machines for operation; therefore, currently approved procedures were utilized after specific procedural changes are made to accommodate machine disposal preparation.

Cascade components (i.e., piping, valves, etc.) located in the X-3001 building Train 3, North Utility Bay, and Mezzanine areas were purged and backfilled to atmospheric pressure to minimize HF exposures. Disconnects were capped to minimize spread of contamination. Some cascade piping required cutting for disposal in approved shipping containers; the openings were sealed prior to disposal.

☒ A description of how the RWPs are reviewed and approved by the decommissioning project management organization

☒ A description of how RWPs are managed throughout the decommissioning project

As described within Section 4.4.2 of the License Application, qualified HP personnel are authorized to approve, issue, update, revise, and close RWPs. The Radiation Protection Manager (RPM) may exempt the requirement for an RWP in certain Radiation Areas as specified in approved procedures.

The limits established for contamination control (surface and airborne) are based on the toxicity of soluble uranium. The Contamination Control program, of which RWPs are a part, is designed to ensure that the inhalation or ingestion of soluble uranium is below the limits stated in 10 CFR 20.1201(e).

An RWP may be issued for any period up to one year, based on the stability and predictability of changes in the radiological conditions of the work area. RWPs are normally closed upon job completion. HP may close an RWP at any time.

Radiological surveys are reviewed to evaluate the adequacy of RWP requirements. RWPs are updated or closed and reissued if radiological conditions change to the extent those protective requirements need to be modified.

☒ A description of how individuals performing the decommissioning tasks are informed of the procedures in the RWP

As described within Section 4.5 of the License Application, the Radiological Worker Training Program outlines the requirements of 10 CFR 19.11 and 19.12 and the workers responsibilities under the RP program. The Radiation Worker Training program is described in Section 11.3.6 of the License Application.

A portion of the training includes a practical exercise stressing adherence to RWP requirements, which includes PPE, hold points, exit monitoring, etc.

IX.c. DECOMMISSIONING MANAGEMENT POSITIONS AND QUALIFICATIONS

☒ A description of the duties and responsibilities of each management position in the decommissioning organization and the reporting responsibility of the position

☒ A description of the duties and responsibilities of each chemical, radiological, physical, and occupational safety-related position in the decommissioning organization and the reporting responsibility of each position

☒ A description of the duties and responsibilities of each engineering, quality assurance, and waste management position in the decommissioning organization and the reporting responsibility of each position

Managerial positions depicted within Figure IX.a-1 of this Decommissioning Plan, having principal responsibilities essential to environmental, health, safety, safeguards, security, and quality for the Lead Cascade, are described in Chapter 2.0 of the License Application.

Organizations with environmental, health, safety, safeguards, security, and quality responsibilities have been established with a reporting chain, independent from the operations organization. Effective lines of communication and authority among the organizations involved in the engineering, environmental, safety, and health, and operations functions of the facility are clearly defined within Chapter 2.0 of the License Application.

☒ The minimum qualifications for each of the positions describe above, and the qualifications of the individuals currently occupying the positions

Chapter 2.0 of the License Application discusses the minimum qualifications for each of the positions, as well as the qualifications, responsibilities, and authorities of these personnel being clearly defined in position descriptions that are accessible to affected personnel and the NRC upon request.

☒ A description of all decommissioning and safety committees

As described within Section 2.2.1 of the License Application, the Facility Safety Review Committee (FSRC) performs multi-discipline reviews of day-to-day and proposed Lead Cascade activities to ensure that these activities are and will be conducted in a safe manner. The FSRC advises the General Manager, American Centrifuge Plant Operations and Decommissioning on matters related to RP, Nuclear Safety, Chemical Safety, Fire Safety, and Environmental Protection. The specifics related to the FSRC are provided within currently approved operating procedures.

As described within Section 3.1.2 of the License Application, the ISA and ISA Summary are maintained and updated by suitably qualified personnel. The ISA Team is responsible for the development and maintenance of the ISA and ISA Summary. The ISA Team is comprised of a diverse group of individuals with expertise in the various activities and operations associated with enrichment operations and expertise in the hazard analysis methods utilized to produce the ISA. The ISA Team methodology is further described in Section 4.1 of the ISA Summary.

As described within Section 4.2.1 of the License Application, the ALARA Committee is an independent advisory group to the General Manager, American Centrifuge Plant Operations and Decommissioning on RP issues. It functions to: (1) monitor selected operational RP issues; (2) advise Lead Cascade management on RP concerns; and (3) review proposed designs, work practices, selected suggestions, and selected projects with regard to contamination control and/or ALARA. Additional details related to the ALARA Committee are further described in the License Application.

IX.d. RADIATION SAFETY OFFICER

☒ A description of the health physics and radiation safety education and experience required for individuals acting as the licensee's RSO
☒ A description of the responsibilities and duties of the RSO
☒ A description of the specific authority of the RSO to implement and manage the licensee's radiation protection program

As described within Section 2.1.2.1.2.1 of the License Application, the RPM is responsible for the RP program and administration on a day-to-day basis, including providing guidance and direction for establishment and implementation of the RP program, and has the authority to deny access to radiological areas for personnel who do not adhere to radiological protection requirements. The RPM also has oversight of all radiological protection procedures in order to maintain the integrity of the RP program. The RPM has direct access to the General Manager, American Centrifuge Plant Operations and Decommissioning and the Senior Vice President, Field Operations for RP matters.

The RPM has, as a minimum, a bachelor's degree in engineering, HP, RP, or the physical sciences or equivalent technical experience, and four years' experience in RP, including six months at a uranium processing plant.

As discussed within Section 2.1 of the License Application, alternates for this key staff position are designated in writing and in accordance with procedural requirements to fulfill the responsibilities and authorities of this position during the incumbent's absence. Additionally, as described in Section 4.3 of the License Application, the RPM and his or her alternates are required to have the technical competence and experience to establish RP programs and the management capability to direct the implementation and maintenance of RP programs.

IX.e. TRAINING

☒ A description of the radiation safety training that the licensee will provide to each employee

As described in Section 4.5 of the License Application and in accordance with currently approved operating procedures, radiological control is provided by controlling access to Lead Cascade areas where radioactive material may be encountered and by requiring that each person who enters those areas or facilities receive the appropriate level of radiological worker training.

As described in Section 11.3.6 of the License Application, Radiological Worker Training is a biennial training requirement for personnel whose job requires them to have unescorted access to radiological restricted areas. Other personnel with unescorted access to the reservation receive biennial General Employee Training, which includes employee radiological safety as described in Section 11.3.4 of the License Application. Plant visitors who are escorted by trained radiological workers receive site access training as described in Section 11.3.5 of the License Application, which includes basic information related to the site and hazards concerns present at the Lead Cascade.

☒ A description of any daily worker "jobside" or "tailgate" training that will be provided at the beginning of each workday or job task to familiarize workers with job-specific procedures or safety requirements

In accordance with currently approved operating procedures and Section 4.4.2 of the License Application, RWPs are a basic implementation tool by which radiological controls are established. RWPs provide information to the worker concerning protective clothing, job/task identification, and special instructions such as radiological hold points to minimize exposure to radioactive materials at the Lead Cascade.

Prior to the workers' entry, the Responsible Manager/Shift Supervisor briefs the workers on the contents of the RWP, when required by the RWP. The RWP is posted at the access point to the respective radiological work area or agreed upon central location. Workers document all data required by the respective RWP Entry Control forms (such as, date, time in, time out, badge number, and dosimeter readings and serial number when required). Workers entering areas covered under RWPs follow all requirements of the RWP and associated tasks.

Additionally, if pre-job briefings are necessary, Health Physics-Industrial Hygiene personnel brief the Responsible Manager/Shift Supervisor. In turn, the Responsible Manager/Shift Supervisor signs the RWP signifying understanding and concurrence with the requirements. The Responsible Manager/Shift Supervisor then briefs the Radiological workers involved of the RWP requirements. If a Radiological Review is required, Health Physics-Industrial Hygiene conducts a formal documented pre-job briefing of the RWP requirements with the Responsible Manager/Shift Supervisor and the Radiological workers involved.

As described in Section 11.3.3.1 of the License Application and in accordance with currently approved operating procedures, training is conducted for job-specific procedures and/or safety requirements. Training will continue to be conducted in accordance with Section 11.3.3.1 of the License Application. Any specific tasks that are identified as pre-train or just-in-time in Task-To-Training procedure matrices that require training will be taught prior to performance of task. Procedure changes, equipment changes, job scope changes, facility modifications, and other changes affecting task performance are monitored and evaluated for their impact on the development or modification of initial and continuing training programs.

☒ A description of the documentation that will be maintained to demonstrate that training commitments are being met

The management measures for training and qualifications are discussed in Section 11.3 of the License Application. Currently approved operating procedures govern the development and implementation of training programs. Training records, such as attendance records, examinations, employee qualification records, and program needs will continue to be maintained in an accurate, auditable manner to document each employee's training in accordance with currently approved operating procedures and as described in Section 11.3.16 of the License Application.

IX.f. CONTRACTOR SUPPORT

☒ A summary of decommissioning tasks that will be performed by contractors
☒ A description of the management interfaces that will be in place between the management and onsite supervisors, and contractor management and onsite supervisors
☒ A description of the oversight responsibilities and authority that the licensee will exercise over contractor personnel
☒ A description of the training that will be provided to contractor personnel by the licensee and the training that will be provided by the contractor
☒ A commitment that the contractor will comply with all radiation safety and license requirements at the facility

As discussed within Section VIII.b of this Decommissioning Plan, classified and/or contaminated equipment removed from the Lead Cascade was slated for disposal in accordance with Security Plan SP-3605-0030. The Licensee contracted with third parties to assist with the decommissioning efforts for the Lead Cascade where needed. Licensee employees prepared, dismantled, and packaged equipment containing radiological hazards in accordance with established Licensee programs and currently approved operating procedures.

EnergySolutions, a contracted third party, provided Waste Profile development for waste streams intended for disposal at the NNSS to meet NNSS WAC. EnergySolutions provided support during the NNSS audit of the Licensee's programs. EnergySolutions also provided a Waste Certifying Official (WCO) trained and qualified in accordance with NNSS requirements. The WCO certified that contents of shipping containers met the NNSS WAC requirements. ACO Maintenance personnel supplied welding services for closure of shipping containers as required by the NNSS WAC. EnergySolutions performed shipment of the waste from Piketon, Ohio to NNSS utilizing an NRC-approved transportation security plan. NR-3605-0010, *Transportation Security Plan for Classified Matter Shipments for the American Centrifuge Plant*, describes how the Licensee satisfies the applicable requirements of 10 CFR Part 95, *Facility Security Clearance and Safeguarding of National Security Information and Restricted Data*, utilizing authorized ground commercial carriers, i.e., Hittman Transport Services, Inc., an EnergySolutions subsidiary, and Tri-State Motor Transit Company.

The Licensee's Project Manager provided the interface between the Licensee and third-party contractor management personnel. The Licensee's Project Manager provided contract oversight

and coordination with third parties. The Licensee's Site Technical Representatives (STR) provided oversight of third party contractor personnel at the floor level and ensured the third-party contractor complied with site safety requirements, which included radiation safety. The STRs also ensured work performed by the third-party contractor remained within the work scope boundary. As stated within Section 2.0 of the License Application, to the extent that the Licensee relies on third party contractor programs and resources, such programs and resources meet 10 CFR Part 70 requirements. The STRs and third-party contractor representatives evaluate deviations in work scope in accordance with selected tasks in the Licensee's programs to ensure the Licensee and third-party contractor personnel comply with license requirements.

As stated within Section 10.3 of the License Application, qualified third-party contractors assisting with decommissioning will be subject to Lead Cascade security and training requirements, and procedural controls. The minimum training requirements are identified in the Statement of Work associated with the third-party contract. This training includes, if necessary, training on radiological requirements, site security requirements and other fundamental topics required for general site access. Additional training requirements may be identified during job hazard analyses conducted by the third-party contractor or identified by the Licensee support organizations during job evaluations. Training for third party contractors is conducted by Licensee personnel. Training requirements may be waived in accordance with the Licensee's programs provided the training is evaluated as equivalent to the Licensee's learning objectives.

X. HEALTH AND SAFETY PROGRAM DURING DECOMMISSIONING: RADIATION SAFETY CONTROLS AND MONITORING FOR WORKERS

X.a. AIR SAMPLING PROGRAM

- ☒ A description which demonstrates that the air sampling program is representative of the workers breathing zones
- ☒ A description of the criteria which demonstrates that air samplers with appropriate sensitivities will be used, and that samples will be collected at appropriate frequencies
- ☒ A description of the conditions under which air monitors will be used
- ☒ A description of the criteria used to determine the frequency of calibration of the flow meters on the air samplers
- ☒ A description of the action levels for air sampling results
- ☒ A description of how minimum detectable activities (MDA) for each specific radionuclide that may be collected in air samples are determined

The Air Sampling program is described within Section 4.7.5 of the License Application and implemented by currently approved operating procedures. During dismantling activities air sampling performed will consist of a combination of general area, grab, and breathing zone (BZ) samples. Action levels are set at 10 percent of the DAC. The DAC (1×10^{-10} microcurie per milliliter [µCi/ml]) and posting level are selected to protect personnel from chemical toxicity hazards associated with soluble uranium.

The only contaminant at the Lead Cascade is Class D uranium. Investigations are performed when airborne radioactivity data indicates personnel exposures exceed 0.8 DAC-hours (10 percent of the DAC [1 x 10^{-11} µCi/ml alpha]). Special bioassay sampling is required when air samples exceed 0.8 DAC-hours; adjustment for respirator use is considered in determining bioassay monitoring.

Air sample data is not used as the primary method to determine internal dose; however, the data is used to prompt bioassay monitoring. Only air samples collected in the workers BZ (approximately 30 cm) are considered representative.

Air sample flow measurement devices are calibrated under standard laboratory conditions at least annually. The National Institute of Standards and Technology (NIST) traceable standards used have accuracy and precision of 20 percent or better.

The calculated detection limits (L_D) for the air sample equipment used at the Lead Cascade are shown in the following Table. L_D is the "true" net signal level which may be *a priori* expected to lead to detection and calculated as follows:

$$L_D = \frac{2.71 + 4.65\sigma_B}{C}$$

where C is the conversion factor to correct counts/minute to µCi/ml and B refers to background.

Table X.a-1 Detection Limits and Calculation Assumptions

Alpha			Beta		
cpm	**unc.**	**Efficiency**	**cpm**	**unc.**	**Efficiency**
0.18	0.09	30.64 percent	0.92	0.21	51.75 percent

Alpha uCi/ml				
BZ L_D	**HV L_D**	**IROFS L_D**	**LV1 L_D**	**LV2 L_D**
2.74 x 10^{-11}	5.18 x 10^{-13}	1.46 x 10^{-11}	6.40 x 10^{-14}	2.22 x 10^{-14}
Beta uCi/ml				
BZ L_D	**HV L_D**	**IROFS L_D**	**LV1 L_D**	**LV2 L_D**
1.91 x 10^{-11}	3.61 x 10^{-13}	1.02 x 10^{-11}	4.45 x 10^{-14}	1.55 x 10^{-14}

1. BZ based on a 45-minute breathing zone sampler
2. HV based on a 15-minute high volume grab sample
3. IROFS based on a 20-minute low volume sampler
4. LV1 based on a 2-day low volume sample
5. LV2 based on a 7-day low volume sample

X.b. RESPIRATORY PROTECTION PROGRAM

☒ A description of the process controls, engineering controls, or procedures to control concentrations of radioactive materials in air

☒ A description of the considerations used which demonstrates respiratory protection equipment is appropriate for a specific task based on the guidance on assigned protection factors

☒ A description of the evaluation which will be performed when it is not practical to apply engineering controls or procedures

The Respiratory Protection program is described within Section 4.6.2 in the License Application and follows the requirements of 29 CFR 1910.134 and 10 CFR Part 20 for use, issuance, training, and qualifications for respirator users. The Licensee uses the protection factors found in 10 CFR Part 20, Appendix A.

Engineering and administrative controls, including access restrictions and the use of specific work practices designed to minimize airborne contamination or loss of contamination control are used to minimize worker internal exposure. When engineering and administrative controls have been applied and the potential for airborne radioactivity still exists, respiratory protection is used to limit internal exposures. Use of respiratory protection is considered under any of the following conditions:

- During entry into posted Airborne Radioactivity Areas;
- During breach of contaminated systems or components;
- During work in areas or on equipment with removable contamination levels greater than 100 times the levels contained in Table 4.6-1 of the License Application (cited in Section V.b of this Decommissioning Plan); and
- During work on contaminated surfaces with the potential to generate airborne radioactivity.

Where practical, engineering controls (e.g., ventilation) are used to minimize exposure to airborne concentrations of soluble uranium and its reaction products (e.g., HF). Mini-gulpers are used routinely to remove airborne contaminants from the worker's BZ to minimize the need for respiratory protection. The primary concern at the Lead Cascade is HF. Mini-gulpers use is specified in RWPs. If HF is less than 0.5 parts per million (ppm), respirator use is not required.

☒ A description of the written procedures maintained to address all the elements of the respiratory protection program

☒ A description of the medical screening and fit testing required before workers will use any respirator that is assigned a protection factor

☒ A description of the use, maintenance, and storage of respiratory protection devices

☒ A description of the respiratory equipment users training program

☒ A description of the considerations made when selecting respiratory protection equipment

Currently approved operating procedures provide the instructions for respiratory protection methods (including the primary method of engineering controls) to minimize safety and health risks at the Lead Cascade.

Health Physics – Industrial Hygiene (HP-IH) specifies respiratory protection equipment required for non-radiological hazards via a Safety and Health Work Permit, or radiological hazards via the RWP, special written instructions, survey reports, or operating procedures. Personnel issued a respirator are responsible for daily cleaning, storage, and inspection of the respirator.

Respiratory protection equipment shall be used as a last resort, not as the primary method of protection. Respirators may be used while engineering controls, such as ventilation, and other procedures are being evaluated or implemented to control hazardous atmospheres. HP-IH considers the following when selecting the minimum required respiratory protection equipment:

- Physical and psychological requirements of the work to be performed
- Additional stress and associated risk from use of respiratory protection equipment
- Applicable service life or change schedule of respiratory protection equipment.
- Factors such as vision loss, ventilation flow, temperature extremes, and movement restrictions
- Effective of ambient noise on communication

Additionally, the Respiratory Protection Program Coordinator ensures only National Institute for Occupational Safety and Health (NIOSH) and Mine Safety and Health Administration certified equipment is used at the Lead Cascade.

Physicians or other licensed health care professionals evaluate workers to ensure that they are medically fit to perform their duties while using respiratory protection equipment. Employees within this program are scheduled a medical evaluation for respirator use before initial assignment and at least once every year thereafter, not to exceed the last day of the anniversary month for the preceding medical evaluation. Additionally, personnel classified as approved respirator users shall be fit-tested on a 12-month frequency (not to exceed 365 days).

To ensure the proper and safe use of a respirator, the minimum training of each user shall include the following elements:

- Reasons for the need of respiratory protection
- Nature, extent, and effects of respiratory hazards to which the person may be exposed
- Explanation of why engineering controls are not being applied or are not adequate and of what effort is being made to reduce or eliminate the need for respirators
- Explanation of why a particular type of respirator has been selected for a specific respiratory hazard
- Instruction in inspecting, donning, checking the fit of, wearing, and doffing the respirator
- Opportunity for each respirator user to handle the respirator, learn how to don and wear it properly, check its seals, wear it in a safe atmosphere, and wear it in a test atmosphere
- Explanation of how maintenance and storage of the respirator are carried out
- Instructions in how to recognize and cope with emergency situations
- Regulations concerning respirator use
- Reporting of respirator malfunctions

Additionally, each respirator user shall be retrained at least annually, not to exceed 365 days.

X.c. INTERNAL EXPOSURE DETERMINATION

☒ A description of the monitoring to be performed to determine worker exposure
☒ A description of how worker intakes are determined using measurements of quantities of radionuclides excreted from, or retained in the human body
☒ A description of how worker intakes are determined by measurements of the concentrations of airborne radioactive materials in the workplace
☒ A description of how worker intakes for an adult, a minor, and a declared pregnant woman (DPW) are determined using any combination of the measurements above, as may be necessary
☒ A description of how worker intakes are converted into committed effective dose equivalent

The internal exposure determination is described within Section 4.7.4 of the License Application and implemented by currently approved operating procedures. Since the primary hazard is exposure to soluble uranium, personnel performing dismantling activities will be placed on a four week bioassay (e.g., urine) sample submission frequency to verify intakes do not exceed 10 mg/week. Urinalysis program action levels are based on 1 mg/week and, if air sampling indicates an exposure of greater than 0.8 DAC-hours/day the individual will be required to submit special bioassay sample(s) for analysis.

X.d. EXTERNAL EXPOSURE DETERMINATION

☒ A description of the individual-monitoring devices which will be provided to workers
☒ A description of the procedure to insure that surveys necessary to supplement personnel monitoring are performed
☒ A description of the action levels for worker's external exposure, and the technical bases and actions to be taken when they are exceeded

The external exposure determination is described within Section 4.7.3 of the License Application and implemented by currently approved operating procedures. Personnel performing dismantling activities were assigned personal TLDs which are read at least quarterly. TLDs are provided and processed by a vendor who is accredited by NVLAP. Investigations are performed if an individual's TLD indicates greater than 250 mrem per quarter.

Personnel who need access to Restricted Areas are provided with a TLD that is processed by a NVLAP-accredited vendor.

Monitoring frequencies are based on exposure potential. With minor exceptions, the following applies for TLD usage at the Lead Cascade:

- Personnel who are Radworker II qualified are placed on a quarterly TLD exchange (Radworker II training allows unescorted access to Restricted Areas)
- Radworker I qualified personnel are placed on an annual TLD exchange (Radworker I training allows unescorted access to areas that requires no personal exit monitoring)
- Upon declaration, pregnant Radworkers are placed on a monthly TLD exchange.

- Non-qualified personnel may be issued a TLD, but must be escorted by an individual with appropriate qualifications when entering Restricted Areas and are placed on an annual exchange frequency
- Tour TLDs are provided as needed

Dose investigations are required by currently approved operating procedures when any of the following occurs:

- TLD results indicate > 50 percent of the Administrative Control Level (ACL) in a calendar quarter
- TLD results indicate > 100 percent of the ACL in a calendar year
- Lost or damaged TLD
- Questionable TLD results from the Vendor

Personnel may be granted an extension of the 500 mrem ACL, if approved by the General Manager, American Centrifuge Plant Operations and Decommissioning; but may not exceed the Federal limit of 5 rem/year.

☒ A description of the type, range, sensitivity, and accuracy of each individual-monitoring device

TLDs are supplied by Mirion Technologies. Mirion maintains NVLAP accreditation to American National Standards Institute (ANSI) N13.11-2009 categories IB, IC, IIA, IIIA, IVAA and ANSI N13.11-2001 category VIA for the TLD used at the Lead Cascade. These categories are appropriate for the radiation energies encountered during enrichment activities (x and γ radiation emitted from uranium and uranium daughters).

The primary complement of RP instrumentation includes alpha/beta count rate and scaler instrumentation plus ion chambers used to evaluate shallow dose and deep dose equivalent readings. Table 4.8-2 of the License Application describes typical instrumentation available to support the Lead Cascade operations.

☒ A description of the use of extremity and whole body monitors when the external radiation field is non-uniform
☒ A description of when audible-alarm dosimeters and pocket dosimeters will be provided
☒ A description of how external dose from airborne radioactive material is determined

Due to the minimal amount of authorized uranium possession at the Lead Cascade and the low dose rates encountered, extremity monitoring is not performed. Audible-alarm and pocket dosimeters are not used at the Lead Cascade.

Additionally, air sample data is consistently < 0.1 percent of DAC; therefore, external dose from airborne radioactive material is not required at Lead Cascade.

X.e. SUMMATION OF INTERNAL AND EXTERNAL EXPOSURES

☒ A description of how the internal and external monitoring results are used to calculate TODE and TEDE doses to occupational workers
☒ A description of how internal doses to the embryo/fetus, which is based on the intake of an occupationally-exposed DPW will be determined
☒ A description of the monitoring of the intake of a DPW, if determined to be necessary
☒ A description of the program for the preparation, retention, and reporting of records for occupational radiation exposures

As described within Section 4.7.3 of the License Application, to comply with the reporting requirements of 10 CFR 20.2206, the Licensee submits personnel monitoring information for the Radiation Exposure Information Reporting System report based on the personnel exposure database. Dose reports are completed as required for personnel monitored in accordance with 10 CFR 20.1502(a). This includes summation of internal and external doses as outlined in Section 7 of Regulatory Guide 8.34, *Monitoring Criteria and Methods to Calculate Occupational Radiation Doses*.

Personnel declaring pregnancy are advised to keep radiation exposure to an embryo or fetus in accordance with the ALARA principle during the entire gestation period. The Licensee complies with the guidelines of Regulatory Guide 8.13, Revision 2, *Instructions Concerning Prenatal Radiation Exposure.*

As described within Section 4.8.5 of the License Application, RP records demonstrate the effectiveness of the overall program and document personnel exposure. Records are maintained in the form required by 10 CFR 20.2110 and are retained as required by 10 CFR 20.2101 through 20.2106 according to the Licensee's Records Management program as outlined within Section 11.7 of the License Application.

X.f. CONTAMINATION CONTROL PROGRAM

☒ A description of the written procedures to control access to, and stay time in, contaminated areas by workers, if they are needed

☒ A description of surveys to supplement personnel monitoring for workers during routine operations, maintenance, clean-up activities, and special operations

☒ A description of the surveys which will be performed to determine the baseline of background radiation levels and radioactivity from natural sources for areas where decommissioning activities will take place

☒ A description in matrix or tabular form which describes contamination action limits (that is, actions taken to either decontaminate a person, place, or area, restrict access, or modify the type or frequency of radiological monitoring)

☒ A description (included in the matrix or table mentioned above) of proposed radiological contamination guidelines for specifying and modifying the frequency for each type of survey used to assess the reduction of total contamination

Current survey data indicates removable contamination levels are minimal. Equipment removal and containerization work was performed under approved Radiation Work Permits with HP coverage. The Contamination Control program, as outlined in Sections 4.4.2, 4.7.1, 4.8.1, and 4.8.2 of the License Application, minimizes the spread of contamination. Contamination control requirements are implemented by currently approved operating procedures. The Contamination Control program consists of the following:

- Radiation Work Permits to provide information to the worker concerning protective clothing, job/task identification, and special instructions such as radiological hold points
- Routine, job coverage, and material release surveys to support dismantling activities. Surveys ensure radiological hazards associated with each activity are properly identified, and relative radiation levels and concentrations of radioactive material are determined. The Routine Survey program is evaluated annually. In addition:
  - Samples may be collected for isotopic analysis if determined necessary for dosimetry investigations
  - Dismantling activities performed by personnel trained to the requirements of the RP program, as described within Section 4.5 of the License Application
- Postings (Table 4.8-1 of the License Application) to alert personnel to the presence of radiation and radioactive materials, aid in minimizing exposures, and prevent the spread of contamination

Table IV.a-2 of this Decommissioning Plan provides a summary of current radiological conditions in areas of the Lead Cascade footprint.

☒ A description of the procedures used to test sealed sources, and to ensure sealed sources are leak tested at appropriate intervals

A Radioactive Source Control program is described within Section 4.8.3 of the License Application and implemented by currently approved operating procedures. The Radioactive

Source Control program establishes source custodians and requires leak testing, accountability, and control of sealed radioactive sources.

X.g. INSTRUMENTATION PROGRAM

☒ A description of the instruments to be used to support the health and safety program

The RP Instrumentation Program is described within Section 4.8.4 of the License Application and implemented by currently approved operating procedures. The primary complement of instrumentation includes alpha/beta count rate and scaler instrumentation plus ion chambers used to evaluate shallow dose and deep dose equivalent readings. Specifically, Table 4.8-2 of the License Application, describes typical instrumentation available to support Lead Cascade operations.

☒ A description of instrumentation storage, calibration, and maintenance facilities for instruments used in field surveys
☒ A description of the methods used to estimate uncertainty bounds for each type of instrumental measurement
☒ A description of air sampling calibration procedures or a statement that the instruments will be calibrated by an accredited laboratory
☒ A description of the instrument calibration and quality assurance procedures

Procedures address calibration, testing, maintenance, modification, and procurement of RP instruments, and the assurance of traceability of their calibrations to the NIST.

As described within Section 4.8.4 of the License Application, radiological portable instruments are calibrated based on specifications derived from applicable vendor's manuals and other nationally recognized guidance as appropriate (e.g., National Council on Radiation Protection 112). The standards found in the ANSI N323 (1978) are followed except for Sections 4.6 and 5.1(3). Calibration of RP instruments are performed by the on-site RadCal facility operated by DOE's Prime Contractor for the DandD activities at PORTS, FBP in Piketon, Ohio.

Calibration sources and equipment used for dose rate instruments are within 5 percent (at 2 sigma) of the stated value and have documented traceability links to the NIST. Large area uranium slab sources are certified to 10 percent by NIST. Calibration sources used to calibrate contamination-monitoring equipment are within 20 percent (at 2 sigma) for activity and 10 percent (at 2 sigma) for surface emission rate.

☒ A description of the method used to estimate the MDC or MDA (at the 95 percent confidence level) for each type of radiation to be detected

To collect data in both the Baseline and recent scoping survey, ACO personnel used a Ludlum Model 2224-1 Alpha-beta Scaler Ratemeter equipped with a 100 cm^2 DP6CD or a Ludlum 43-89 dual phosphor alpha/beta scintillation probe. Based on data from several different instruments, the average detection limit (L_D) is the true net signal level that may be expected (*a priori*) to lead to

detection. Calculated as follows:

$$L_D = 2.71 + 4.65\sigma_B$$

Data from a recent Reference Point Background study performed with a Ludlum 2224 in X-3002 building shows the expected L_D in both cpm and dpm.

Table X.g-1 Detection Limits for Ludlum Model 2224-1

	cpm		dmp / 100 cm^2	
L_D	**Alpha**	**Beta**	**Alpha**	**Beta**
Wall	**10.3**	**65.2**	**125**	**285**
Floor	**11.6**	**77.5**	**141**	**339**
Column	**9.5**	**51.1**	**116**	**223**

Using the above data, for scanning items and areas the calculated minimum detectable count rate (MDCR) is approximately 16 cpm alpha and 137 cpm beta (MDCR based on MARSSIM Chapter 6 calculation accounting for surveyor efficiency). This calculation assumed a 4 second pause time over area with elevated count rate. Testing at the Lead Cascade indicates that an area with 100 cpm (alpha plus beta) above background is easily distinguishable.

The total weighted efficiency for a mixture of uranium using the Ludlum 2224 equipped with a 100 cm^2 dual phosphor alpha/beta scintillation detector is calculated as follows:

$$Wt\ Eff = \sum AF * e_i * e_s$$

where:

$Wt\ Eff$ = Total weighted Efficiency

AF = Fraction of the radionuclide in the mixture

e_i = Efficiency for the radionuclide (^{230}Th efficiency used for uranium, ^{90}Sr efficiency used for ^{243m}Pa, and ^{99}Tc efficiency used for the ^{231}Th and ^{234}Th)

e_s = Source efficiency; International Organization for Standardization recommends using 0.25 for alpha and Th betas and 0.5 for ^{243m}Pa betas to account for self-absorption losses.

Table X.g-2 Weighted Efficiency

Radionuclide	Rad / Avg Energy (MeV)	Activity Fraction	e_i	e_s	Eff
U-238	Alpha / 4.2	0.2424	0.358	0.25	0.0217
Th-234	Beta / 0.0435	0.2424	0.161	0.25	0.0098
Pa-234m	Beta / 0.819	0.2424	0.351	0.5	0.0425
U-234	Alpha / 4.7	0.2502	0.358	0.25	0.0224
U-235	Alpha / 4.4	0.0113	0.358	0.25	0.0010
Th-231	Beta / 0.0764	0.0113	0.161	0.25	0.0005
	Nat. Assay	Total Weighted Eff			0.0978

Therefore, when 100 cpm above background is observed a static survey of the location is recorded. If the total observed counts indicate greater than 1,000 dpm/100 cm^2 alpha, additional locations within the general area are collected to ascertain if elevated levels are wide spread.

When recording contamination levels, e_s is set to 0.25 for alpha and 0.5 for beta and applied to the final results. The formula for reporting results is:

$$\frac{dpm}{100cm^2} = \frac{GCPM - BKG}{Eff * e_s}$$

BKG is defined as the daily average count rate of the reference point. This will be used for direct alpha and beta.

Since uranium is an alpha emitter and uranium nuclides result in the most dose in the first year, the primary focus of the surveys will be on alpha results. However, both alpha and beta results will be recorded and evaluated.

If a 1 minute stationary count indicates > 1,000 dpm/100 cm^2, a minimum of five additional readings in a circle within a 3-meter diameter surrounding the elevated reading. Need for decontamination will be evaluated based on the average contamination levels.

X.h. NUCLEAR CRITICALITY SAFETY (NCS)

☒ A description of how the NCS functions, including management responsibilities and technical qualifications of safety personnel, will be maintained when needed throughout the decommissioning process

The purpose of the Lead Cascade was to demonstrate the viability of the centrifuge design to be utilized in the American Centrifuge Plant. The Lead Cascade was only licensed to operate up to 240 centrifuge machines, so a fissile material mass possession limit was set at 250 kg for UF_6. The enrichment of UF_6 was limited to 10 wt. percent ^{235}U and its associated possession limit was effectively set at 700 g per 10 CFR 70.24. The Lead Cascade has never exceeded these limits. Given these facts, a nuclear criticality event is not credible, so the Lead Cascade has never had to implement any nuclear criticality safety controls beyond facility inventory controls. A full

nuclear criticality safety program has never been established; therefore, there are no nuclear criticality safety functions to maintain for the decommissioning process.

Section 5.0 of the License Application for the Lead Cascade states, in part, in accordance with the requirements contained in 10 CFR 70.62, the likelihood and risks of an inadvertent nuclear criticality were evaluated in the ISA. The evaluation considered moderation events, maintenance evolutions, machine upset conditions, and cylinder operations. The ISA concluded that there were no inadvertent nuclear criticality accident scenarios that could be identified for the Lead Cascade, due to the small quantity of ^{235}U that is present in the facility. The facility has established a threshold of 1 wt. percent or higher enriched ^{235}U and 100 g or more of ^{235}U for determining when an evaluation for NCS considerations of planned operations must be performed. A 100 g ^{235}U limit was chosen as a threshold above which a Nuclear Criticality Safety Evaluation is required. This mass is a minimum of a factor of 10 below the minimum critical mass at 10 percent ^{235}U enrichment, regardless of whether the material is non-oily, oily, or heterogeneous for a fully reflected system. Based on this, the value is sufficiently low to use as a threshold limit. In view of this threshold, many of the Lead Cascade NCS program features described in this chapter may not be required to be implemented. In this regard, the NCS program provides the framework for a defense-in-depth philosophy to help ensure the risk of inadvertent criticality is maintained acceptably low. The NCS program also provides the framework and resources for evaluating Lead Cascade performance in establishing NCS analyses and controls for the design and operation of a uranium enrichment facility.

The Lead Cascade ISA established a set of nuclear safety controls to meet the 10 CFR 70.61 performance requirements based on the UF_6 possession limit. The Lead Cascade organizational structure has been realigned to meet the functional requirements necessary to support decommissioning activities in a safe and efficient manner throughout the decommissioning process. A nuclear safety management position will be maintained to ensure the decommissioning activities are performed in a manner which maintains the nuclear safety bases of the Lead Cascade and American Centrifuge Plant. Managers and personnel responsible for activities associated with the handling of licensed material will maintain their associated skills to ensure the decommissioning and demolition activities are carried out in a manner that will not increase the likelihood or the consequences of any credible accident sequences or create any new accident sequences. Management measures will be maintained as well to ensure the availability and reliability of applicable IROFS.

☒ A description of how an awareness of procedures and other items relied on for safety will be maintained throughout decommissioning among all personnel, with access to systems that may contain fissionable material in sufficient amounts for criticality

The Lead Cascade has no credible nuclear criticality accidents in operational or decommissioning modes so there is no concern any decommissioning activities will cause a criticality accident.

The Lead Cascade management expectation is that decommissioning activities will be carried out in a safe and efficient manner which ensures the safety and wellbeing of the workforce, public, and environment at all times. IROFS still required to meet the 10 CFR 70.61 performance requirements during the decommissioning process will be maintained as necessary to ensure their

availability and reliability through the application of management measures. The Training program will continue to require ongoing training to ensure competency levels are maintained according to the complexity of the tasks at hand, and assure reliability and availability of the structures, systems, and components. Decommissioning activities which could initiate accident sequences of concern will be performed in accordance with currently approved operating procedures.

☒ A summary of the review of NCSA's or the ISA indicating either that the process needs no new safety procedures or requirements, or that new requirements or analysis have been performed

The lone Nuclear Criticality Safety Approval demonstrates, given facility inventory controls, the Lead Cascade has no credible nuclear criticality accidents in operational or decommissioning modes. The Lead Cascade ISA has been reviewed along with the decommissioning activities with the conclusion that no new safety analysis is needed and no new IROFS are necessary. The current Lead Cascade ISA is bounding of the decommissioning activities.

☒ A summary of any generic NCS requirements to be applied to general decommissioning, decontamination, or dismantlement operations, including those dealing with systems that may unexpectedly contain fissionable material

As discussed above, due to the limited amount of inventory used during operations of the Lead Cascade there were no credible accident scenarios related to a nuclear criticality event. Since the shutdown of the Lead Cascade, the licensed material was evacuated into a minimal number of UF_6 cylinders and removed from the cascade area where decommissioning activities occur. All 12B cylinders were shipped out of the MBA on April 5, 2017. The only licensed material remaining in the cascade is the holdup of uranium compounds in process equipment that cannot be readily accessed; therefore, no generic NCS requirements are required during the decommissioning activities.

X.i. HEALTH PHYSICS AUDITS, INSPECTIONS, AND RECORDKEEPING PROGRAM

☒ A general description of the annual program review conducted by executive management
☒ A description of the types and frequencies of surveys and audits to be performed by the RSO and RSO staff

HP audits and inspections are outlined in Chapter 4.0 and Section 11.5 of the License Application. Scheduled internal assessments and inspections performed include the following:

- Annual RP program report (required by 10 CFR Part 20) summarizes the radiological conditions at the Lead Cascade
- Annual Assessment of Airborne Radioactivity Monitoring
- Annual Assessment Routine Survey program
- Annual Assessment of Respiratory Protection program

- Monthly Boundary Assessment to ensure radiological posting and housekeeping are acceptable
- In addition, as discussed within Section 11.5.2 of the License Application, Quality Assurance (QA) periodically audits the RP program and/or program elements in accordance with currently approved operating procedures

☒ A description of the records to be maintained of the annual program review and executive audits

☒ A description of the process used in evaluating and dealing with violations of NRC requirements or license commitments identified during audits

☒ A description of the records maintained of RSO audits

As discussed within Section 4.8.5 of the License Application, RP records are maintained in accordance with the requirements of Section 11.7 of the License Application. HP records are stored in the Licensee's Electronic Document Management System (EDMS) in accordance with currently approved operating procedures.

Reports and notifications of RP issues are made as required by 10 CFR Part 20, Subpart M; 10 CFR 30.50; 10 CFR 40.60; 10 CFR 70.50; and/or 10 CFR 70.74. Events requiring reporting to the NRC are investigated, tracked in a database, and monitored through completion in accordance with the Corrective Action program. Details of reporting and notification for Lead Cascade incidents are described in Section 11.6 of the License Application. Additionally, Section XIII.e of this Decommissioning Plan provides an expanded discussion related to the Corrective Action program.

XI. ENVIRONMENTAL MONITORING AND CONTROL PROGRAM

XI.a. ENVIRONMENTAL ALARA EVALUATION PROGRAM

☒ A description of ALARA goals for effluent control

As described within Section 9.2.1.1 of the License Application, gaseous and liquid effluent treatment systems, as appropriate, are used to maintain releases of radioactive material to unrestricted areas below the limits specified in 10 CFR 20.1301 and 40 CFR Part 190 and in accordance with the ALARA policy. Gaseous effluent control systems are also used to maintain releases of radioactive material to unrestricted areas below the dose constraint in 10 CFR 20.1101 and the dose limit in 40 CFR 61.92.

The ALARA goal for airborne radioactive releases is 5 percent of the NRC constraint level (10 CFR 20.1101) and EPA limit (40 CFR 61.92), or an annual TEDE of 0.5 mrem to the most exposed member of the public. This is also less than 15 percent of the most restrictive limit under 40 CFR Part 190, based on site experience.

The ALARA goal for liquid radioactive releases is 10 percent of the airborne ALARA goal, or an annual TEDE of 0.05 mrem to the most exposed member of the public. This is equivalent to 0.05 percent of the 10 CFR 20.1301 limit on annual public dose.

☒ A description of the procedures, engineering controls, and process controls to maintain doses ALARA

The site ALARA program is implemented through currently approved operating procedures. These procedures establish, define, and implement the ALARA program by which exposure to radiation, and exposure to and release of radioactive materials, is maintained as low as reasonably achievable.

Radionuclide releases to air are measured by the continuous vent sampler described in Section 9.2.2.1.3 of the License Application or estimated in accordance with guidance in 40 CFR Part 61, Appendices D and E. Atmospheric dispersion of the releases is modeled and the consequent public radiation dose is estimated using EPA approved computer models in accordance with EPA guidance. An annual report summarizing the atmospheric releases and the dose assessment results is submitted in accordance with 40 CFR Part 61 Subpart H and EPA guidance. In accordance with EPA requirements, these calculations include all gaseous radioactive effluents.

Table XI.a-1 below provides the Collective Effective Dose Equivalents (EDE) (i.e., Population Doses) in person-rem/yr. due to ACO operations since the beginning of the Lead Cascade. The Collective EDEs are provided for the 50-mile radius population and the village of Piketon; the individual EDEs for the most exposed individual (MEI) due to ACO operations are provided for comparison.

Because of the change in ACO's responsibilities, Table XI.a-1 below lists the public doses due to combined Lead Cascade and Gaseous Diffusion Plant (GDP) emissions through 2010, and the corresponding public doses from the Lead Cascade alone from 2007 through 2016. Public doses from the Lead Cascade have consistently been much lower than the GDP doses. Thus, to observe any trend in Lead Cascade releases, the Lead Cascade doses are separated and considered independently. In addition, the effects of the presumed ^{99}Tc emissions have been removed from the pre-2011 Lead Cascade public doses.

Table XI.a-1 Annual Dose Due to ACO Airborne Emissions Years 2006-2016 [1]

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	EPA Std
50-mile Collective EDE[2,4]	0.014	0.077	0.10	0.14	0.81							NA
	LC only	5.9×10^{-5}	6.5×10^{-5}	7.1×10^{-5}	3.9×10^{-5}	3.8×10^{-5}	5.3×10^{-5}	4.6×10^{-5}	6.8×10^{-5}	7.4×10^{-5}	2.97×10^{-5}	
Piketon Collective EDE[3,4]	0.0037	0.0024	0.0051	0.0046	0.028							NA
	LC only	2.3×10^{-6}	2.7×10^{-6}	2.5×10^{-6}	1.7×10^{-6}	2.1×10^{-6}	2.1×10^{-6}	2.1×10^{-6}	3.6×10^{-6}	3.2×10^{-6}	1.39×10^{-6}	
MEI EDE[5] (mrem/yr)	0.0045	0.0034	0.0053	0.0069	0.051							10
	LC only	3.4×10^{-6}	3.4×10^{-6}	2.8×10^{-6}	2.3×10^{-6}	2.6×10^{-6}	2.7×10^{-6}	3.7×10^{-6}	5.3×10^{-6}	6.7×10^{-6}	2.10×10^{-6}	

Notes:
1. All dose figures in this table are for ACO operations only. Prior to 2011 this included both GDP and American Centrifuge Program operations. From 2011 onward, ACO operations are limited to American Centrifuge Program operations.
2. Collective EDE in person-rem/year for 50-mile radius. This is a summation of the dose to each individual living within a 50-mile radius.
3. Collective EDE in person-rem/year for the Village of Piketon. This is a summation of the dose to each individual living within the village.
4. Population distributions for calendar year 2009 and earlier are based on 2000 census data.
5. Population distributions for calendar year 2010 and later are based on 2010 census data.

As described within Section 9.2.1.2.1 of the License Application, all routine gaseous effluents from the Lead Cascade flow through the purge vacuum (PV) or evacuation vacuum (EV) systems as described within Section 1.1 of the License Application. The X-3001 building process vent was utilized during Lead Cascade operations; however, it will not be utilized during decommissioning due to the shutdown of the cascade operations.

As described within Section 9.2.1.2.1 of the License Application, centrifuge machines may be disassembled on the static stand in the X-7726 facility (or in appropriate areas of the X-3001 or X-7725 buildings if use of the X-7726 facility equipment is not required). Centrifuge machines which have been in service were opened using appropriate PPE, and may also include engineered local ventilation systems to capture any residual uranium. Consequently, there should be no airborne radioactive effluents from the X-7726 facility or any of the support buildings (e.g., X-7725 building, X-7727H corridor, and X-3012 building). The workspace air in areas which may have airborne uranium is monitored as described within Section 4.7 of the License Application.

As described within Section 9.2.1.2.2 of the License Application, sanitary water is treated at the X-6619 Sewage Treatment Plant (STP). The X-6619 STP uses screening and a grit chamber as preliminary treatment followed by an activated sludge treatment system. Mixed liquid from the aeration basins is clarified, filtered using multimedia sand filters, and then chlorinated/dechlorinated. Sludge is aerobically digested and dried on sludge drying beds. Sludge produced by the facility is drummed and stored pending future disposal, and the effluent discharges directly to the Scioto River.

Any incidental spills inside the facilities are collected by the LEC System. These LEC (underground) tanks collect and contain leaks/spills until they have been sampled and the results properly evaluated. The contents are then either disposed of via the X-6619 STP or containerized for disposal (based on analytical results).

Storm water runoff or outside spills go to one of two leased water outfalls: the X-2230N and X-2230M ponds. A composite sampler is utilized on the ponds' discharge. Samples are analyzed for total uranium concentrations, gross alpha, gross beta, and technetium beta activities.

☒ A description of the ALARA reviews and reports to management

As described within Section 9.2.1.3 of the License Application, action levels for control of both gaseous and liquid radioactive effluents are established based on the ALARA philosophy. Baseline Effluent Quantities (BEQ) have been established for every continuously monitored radiological vent and liquid discharge point to unrestricted areas. These BEQs are reviewed annually, at a minimum, to ensure the principles described in the facility's ALARA policy are followed. Recommendations for changes, if any, are reviewed by senior management.

XI.b. EFFLUENT MONITORING PROGRAM

☒ A demonstration that background and baseline concentrations of radionuclides in environmental media have been established through appropriate sampling and analysis
☒ A description of the known or expected concentrations of radionuclides in effluents
☒ A description of the physical and chemical characteristics of radionuclides in effluents

Section 9.2.2 of the License Application discusses effluent and environmental monitoring at the Lead Cascade. Specifics related to anticipated effluent levels, demonstration of compliance, monitoring of release points, action levels, as well as other permits and licenses for airborne, gaseous, and liquid effluents are provided within Section 9.2.2 of the License Application.

☒ A summary or diagram of all effluent discharge locations
☒ A demonstration that samples will be representative of actual releases
☒ A summary of the sample collection and analysis procedures
☒ A summary of the sample collection frequencies

The X-3001 building process vent, which served both the EV and PV systems which were shut down and removed, will not be used during the decommissioning efforts. Figure 9.2-1 of the License Application, depicts the location of the Lead Cascade outfalls. As discussed within Section 9.2.2.2.3 of the License Application, radiological analyses are performed on samples from these leased outfalls. Outfalls are monitored with composite samplers and analyzed weekly. Aliquots from these samples are analyzed for total uranium concentrations, gross alpha, gross beta, and technetium beta activities. The ratio of alpha activity to total uranium, along with process data, is used to calculate the proportions of the individual uranium isotopes. Sampling activities will be performed in accordance with currently approved operating procedures. Specific details of the analytical methods are presented within Section 9.2.2.5 of the License Application.

☒ A description of the environmental monitoring recording and reporting procedures

Environmental monitoring recording and reporting complies with the requirements of Chapter 9.0 of the License Application, EPA permits, and applicable currently approved operating procedures/programs.

☒ A description of the quality assurance program to be established and implemented for the effluent monitoring program

Effluent Monitoring program activities are performed in accordance with Section 9.2.2 of the License Application and currently approved operating procedures.

XI.c. EFFLUENT CONTROL PROGRAM

☒ A description of the controls that will be used to minimize releases of radioactive material to the environment

The Effluent Controls program is discussed within Section 9.2.1.2 of the License Application and maintained in accordance with currently approved operating procedures.

☒ A summary of the action levels and a description of the actions to be taken should a limit be exceeded

Table 9.2-1 and Sections 9.2.2.1.4 and 9.2.2.2.4 of the License Application discuss the action levels for the control of gaseous and liquid radioactive effluents. Currently approved operating procedures are in place for monitoring, tracking, and evaluating gaseous and liquid radiological releases to the environment. These procedures provide guidance to ensure compliance with the ALARA goals, as well as provide the action levels and actions to be taken, when necessary.

☒ A description of the leak detection systems for ponds, lagoons, and tanks

Section 9.2.2.2.3 of the License Application discusses the monitoring of liquid release points at the Lead Cascade. The Licensee has no lagoons, but leases two water outfalls (X-2230M and X-2230N ponds). Storm water runoff from the X-3001 building, X-3012 building, and Southern portion of the X-7727H corridor and the associated parking areas flows to the X-2230M pond. Storm water runoff from the X-7725 building, X-7726 facility, and Northern portion of the X-7727H corridor and the associated parking areas flows to the X-2230N pond. The X-2230M and X-2230N ponds provide a quiescent zone for settling suspended solids and dissipation of chlorine, and oil containment. The ponds discharge to the Scioto River via separate unnamed creeks in accordance with 10 CFR 20.1301.

There is no leak detection system for these outfalls; however, these outfalls are monitored through weekly analysis derived from composite samplers to quantify radiological waterborne effluents. Outfall samples are analyzed for Gross Alpha and Gross Beta Activity, ^{99}Tc Activity and Total Uranium concentrations. Measurable Gross Alpha Activity is presumed to be due to uranium discharge from uranium enrichment operations, while Gross Alpha Activities below the MDA are

presumed to be due to naturally occurring radioactive materials. The isotopic distribution of enriched uranium discharges (i.e., ^{234}U, ^{235}U, ^{238}U) is estimated to match the measured Gross Alpha Activity based on process knowledge. ^{99}Tc is a fission product that has contaminated much of the national fuel cycle and is present on the reservation. Measured technetium concentrations in reservation outfalls have not been present for several years, but are detected occasionally. ACO therefore monitors radioactive effluents for technetium.

Routine sampling of these outfalls (required by the National Pollutant Discharge and Elimination System [NPDES] Permit, number OIS000023*DD) has identified no radioactive material above background levels.

Tables XI.c-1 and XI.c-2 provide the pCi/l for the Radiological Discharges to Surface Water from Outfall 012 / X-2230M and Outfall 013 / X-2230N ponds over the past twelve years.

Table XI.c-1 Radiological Discharges to Surface Water
Outfall 012 / X-2230M Southwest Holding Pond
Years 2006-2017

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017[3]
Uranium pCi/l												
Number of Samples [1]	34	52	52	52	52	52	53	52	52	52	52	47
Number of Samples < [2]	1	3	7	1	3	5	2	8	6	6	2	3
Average	< 8.25E-01	< 7.13E-01	< 1.10E+00	< 9.92E-01	< 1.14E+00	< 1.13E+00	< 8.91E-01	< 1.14E+00	< 9.76E-01	< 1.19E+00	< 1.03E+00	8.86E-01
Standard Deviation	5.66E-01	4.63E-01	9.08E-01	5.31E-01	9.65E-01	9.54E-01	6.58E-01	8.98E-01	5.48E-01	1.14E+00	9.81E-01	1.04E+00
Maximum	3.80E+00	2.60E+00	4.62E+00	4.13E+00	5.81E+00	4.80E+00	4.31E+00	3.88E+01	3.48E+00	6.87E+00	5.85E+00	6.52E+00
3 Sigma	< 1.22E+01	< 8.51E+00	< 1.50E+01	< 1.34E+01	< 1.86E+01	< 1.55E+01	< 1.38E+01	< 1.28E+01	< 1.14E+01	< 2.18E+01	< 1.86E+01	< 2.04E+01
Technetium pCi/l												
Number of Samples [1]	34	52	52	52	52	52	53	52	52	52	52	45
Number of Samples < [2]	33	52	52	52	52	49	53	52	52	52	52	45
Average	< 9.42E+00	< 9.18E+00	< 9.11E+00	< 9.00E+00	< 9.56E+00	< 9.23E+00	< 8.70E+00	< 8.83E+00	< 7.11E+00	< 7.21E+00	< 9.12E+00	< 7.33E+00
Standard Deviation	1.92E+00	< 1.64E-01	< 6.85E-01	< 2.76E-01	< 8.92E-01	1.75E+00	< 8.22E-01	< 3.49E-01	< 6.27E-01	< 3.54E-01	< 1.35E+00	< 4.75E-00
Maximum	2.02E+01	< 9.50E+00	< 9.89E+00	< 9.67E+00	< 1.24E+01	1.80E+01	< 9.68E+00	< 9.28E+00	< 9.66E+00	< 8.04E+00	< 1.15E+01	< 8.52E+00
3 Sigma	< 7.00E+01	< 3.77E+01	< 3.88E+01	< 3.80E+01	< 4.68E+01	< 6.32E+01	< 3.77E+01	< 3.67E+01	< 3.61E+01	< 3.13E+01	< 4.36E+01	< 3.26E+01

Notes:
1. The "number of samples" shows the total number of samples collected, including replicate and duplicate samples collected for QA purposes.
2 The "number of samples <" shows the number of samples that were lower than the Minimum Detectable Concentration.
3. 2017 Outfall results do not represent the entire year (includes sample results through October 2017).

Table XI.c-2 Radiological Discharges to Surface Water
Outfall 013 / X-2230N West Holding Pond
Years 2006-2017

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017[3]
Uranium pCi/l												
Number of Samples [1]	34	52	52	52	52	52	53	52	52	52	52	47
Number of Samples < [2]	2	4	4	2	6	4	5	6	9	4	5	2
Average	< 9.98E-01	< 7.96E-01	< 9.74E-01	< 1.10E+00	< 1.31E+00	< 1.01E+00	< 1.15E+00	< 1.14E+00	< 1.02E+00	< 8.03E-01	< 1.15E+00	< 6.16E-01
Standard Deviation	1.46E+00	8.17E-01	1.28E+00	1.12E+00	1.68E+00	1.07E+00	2.19E+00	1.57E+00	8.03E-01	6.56E-01	1.39E+00	3.74E-01
Maximum	8.60E+00	3.80E+00	7.31E+00	7.55E+00	1.08E+01	6.44E+00	1.60E+01	8.95E+00	3.88E+00	3.78E+00	1.68E+00	19.4E+00
3 Sigma	< 2.68E+01	< 1.22E+01	< 2.29E+01	< 2.38E+01	< 3.37E+01	< 2.03E+01	< 4.91E+01	< 2.80E+01	< 1.27E+01	< 1.21E+01	< 1.92E+01	< 6.44E+00
Technetium pCi/l												
Number of Samples [1]	34	52	52	52	52	52	53	52	52	52	52	45
Number of Samples<[2]	34	52	52	52	52	50	53	52	52	52	52	45
Average	< 9.04E+00	< 9.16E+00	< 9.04E+00	< 8.94E+00	< 9.52E+00	< 9.16E+00	< 8.67E+00	< 8.78E+00	< 6.98E+00	< 7.15E+00	< 8.94E+00	< 7.39E+00
Standard Deviation	< 2.08E-01	< 1.73E-01	< 6.72E-01	< 2.61E-01	< 8.91E-01	1.60E+00	< 8.40E-01	< 4.89E-01	< 6.72E-01	< 3.10E-01	< 1.26E+00	< 4.44E-01
Maximum	< 9.40E+00	< 9.50E+00	< 9.69E+00	< 9.41E+00	< 1.24E+01	1.75E+01	< 9.49E+00	< 9.31E+00	< 1.00E+01	< 7.87E+00	< 1.10E+01	< 8.64E+00
3 Sigma	< 3.72E+01	< 3.77E+01	< 3.81E+01	< 3.72E+01	< 4.67E+01	< 6.17E+01	< 3.71E+01	< 3.67E+01	< 3.70E+01	< 3.08E+01	< 4.19E+01	< 3.33E+01

Notes:
1. The "number of samples" shows the total number of samples collected, including replicate and duplicate samples collected for QA purposes.
2 The "number of samples <" shows the number of samples that were lower than the Minimum Detectable Concentration.
3. 2017 Outfall results do not represent the entire year (includes sample results through October 2017).

There is one underground storage tank (UST) located at the X-6000 Cooling Tower Pump House, Air Plant, and Air Plant Support Systems, and one UST located at the X-1020 Emergency Operations Center. These USTs utilize Automatic Tank Gauging, which is a method of leak detection that utilizes an automatic product level monitor to test for the loss of regulated substance and to conduct inventory control. Also, an Interstitial and Piping Alarm System, which is a method of leak detection utilizing a double-walled system and monitoring devices capable of detecting a release between the inner wall of the tank and the liner, is utilized. Leak tests are performed automatically on a weekly basis for both USTs.

Aboveground storage tanks (AST) are double walled and/or diked. ASTs are inspected monthly.

No radioactive material is stored within any UST or AST.

☒ A description of the procedures to ensure that releases to sewer systems are controlled and maintained to meet the requirements of 10 CFR 20.2003

Currently approved operating procedures are in place: (1) to define the requirements and responsibilities for ensuring compliance with the NPDES Permit issued by the Ohio EPA; (2) monitoring and management of wastewater collected in LEC tanks; and (3) prevention of spills or chemicals which would pollute the ground water and/or flow to the outfalls.

☒ A summary of the estimates of doses to the public from effluents and a description of the method used to estimate public dose

Currently approved operating procedures establish the methodology for evaluating and demonstrating compliance with the public radiation dose limits in 10 CFR 20.1301; 40 CFR Part 61, Subpart H; and 40 CFR Part 190 in accordance with 10 CFR 20.1302, applicable EPA guidance and Chapter 9.0 of the License Application.

The dose calculations are made using the CAP88 package of computer codes. This package contains an approved version of the AIRDOS-EPA and DARTAB computer codes and the ALLRAD88 radionuclide data file. The CAP88-PC, Version 3 updated the original ALLRAD88 data with the data from Federal Guidance Report No. 11. Recorded doses have been consistently less than 0.01 mrem/year.

XII. RADIOACTIVE WASTE MANAGEMENT PROGRAM

XII.a. SOLID RADWASTE

☒ A summary of the types of solid radwaste that are expected to be generated during decommissioning operations

☒ A summary of the estimated volume, in cubic feet, of each solid radwaste type summarized in Line 1 above

☒ A summary of the radionuclides (including the estimated activity of each radionuclide) in each estimated solid radwaste type summarized in Line 1 above

[See Appendix C of this Decommissioning Plan for additional information]

☒ A summary of the volumes of Class A, B, C, and Greater-than-Class-C solid radwaste that will be generated by decommissioning operations

[See Appendix C of this Decommissioning Plan for additional information] No Class B, C, or Greater than Class C solid radwaste is anticipated to be generated during the Lead Cascade decommissioning efforts.

☒ A description of how and where each of the solid radwaste summarized in Line 1 above will be stored onsite prior to shipment for disposal

Section 9.2.2.3.3 of the License Application details the current storage capabilities and commitments. These storage requirements are flowed into currently approved operating procedures. Additional classified matter storage requirements are documented within Chapter 2.0 of the Security Program and applicable security plans.

Process equipment was dismantled and handled as contaminated waste. The waste was consolidated and containerized to minimize the volume. Waste containers were stored in approved Security Areas until ready for shipment. Waste can be shipped from any Lead Cascade building/facility as necessary. Approved waste handling methods will be utilized to ensure that safety, security, and regulatory requirements are maintained.

☒ A description of how each of the solid radwastes summarized in Line 1 above will be treated and packaged to meet disposal site acceptance criteria prior to shipment for disposal

The solid radioactive waste removed from the Lead Cascade as handled and packaged in accordance with Section 9.2.2.3 of the License Application and activities were performed in accordance with currently approved operating procedures and/or new procedures developed in accordance with Section 11.4 of the License Application. Additional handling and packaging requirements may be augmented by the disposal facility selected for final processing as previously described in Section IX.f of this Decommissioning Plan.

☒ If appropriate, how the licensee intends to manage volumetrically contaminated material

The Lead Cascade does not currently have any volumetrically contaminated solid radwaste and none was generated during the decommissioning activities.

☒ A description of how the licensee will prevent contaminated soil, or other loose solid radwaste, from being re-disbursed after exhumation and collection

As discussed within Section IV.c of this Decommissioning Plan, there are no areas exterior of the Lead Cascade buildings/facilities (X-3001 and X-7726) contaminated by Lead Cascade licensed activities. There have been no uncontrolled releases of licensed material, no spills, and no discharges that could be attributed to Lead Cascade activities.

☒ The name and location of the disposal facility that the licensee intends to use for each solid radwaste type summarized in Line 1 above

Classified and unclassified, low-level contaminated waste has been shipped to the DOE's NNSS in North Las Vegas, NV. Final waste shipments were transported to NNSS on December 11, 2017.

XII.b. LIQUID RADWASTE

☒ A summary of the types of liquid radwaste that are expected to be generated during decommissioning operations

☒ A summary of the estimated volume, in liters, of each liquid radwaste type summarized in Line 1 above

☒ A summary of the radionuclides (including the estimated activity of each radionuclide) in each liquid radwaste type summarized in Line 1 above

[See Appendix C of this Decommissioning Plan for additional information]

☒ A summary of the estimated volumes of Class A, B, C, and Greater-than-Class-C liquid radwaste that will be generated by decommissioning operations

[See Appendix C of this Decommissioning Plan for additional information] No Class B, C, or Greater than Class C liquid radwaste was generated during the Lead Cascade decommissioning efforts.

☒ A description of how and where each of the liquid radwastes summarized in Line 1 above will be stored onsite prior to shipment for disposal

Section 9.2.2.3.3 of the License Application details the current storage capabilities and commitments. These storage requirements are flowed into currently approved operating procedures. The oils removed from the Lead Cascade equipment were handled, packaged,

and stored following approved RWP requirements, prior to the on-site transfer to FBP occurring.

☒ A description of how the each of the liquid radwastes summarized in Line 1 above will be treated and packaged to meet disposal site acceptance criteria prior to shipment for disposal

The oils removed from the Lead Cascade equipment were handled and packaged in accordance with Section 9.2.2.3 of the License Application and activities were performed in accordance with currently approved operating procedures and/or new procedures developed in accordance with Section 11.4 of the License Application. The oils removed from the Lead Cascade were handled through a reverse work authorization and FBP accepted ownership for final disposal.

☒ The name and location of the disposal facility that the licensee intends to use for each liquid radwaste type summarized in Line 1 above

Unclassified, low-level contaminated liquid waste from centrifuge and component disassembly was handled as an on-site transfer for processing to the DOE's Prime Contractor for the DandD activities at PORTS, FBP in Piketon, Ohio.

XII.c. MIXED WASTE

☒ A summary of the types of solid and liquid mixed waste that are expected to be generated during decommissioning operations

Only solid LLMW was present during decommissioning of the Lead Cascade. Examples of this solid LLMW include various electronic components from the Lead Cascade such as the Distributed Control System, Digital Acquisition System, mass spectrometer electronic components (e.g., servers, modules, switches, PCs, monitors, cards, flash drives, CDs, floppy disks, etc.), lead dampers, cadmium isolators, and Machine Cooling Water/PV/EV panel views.

☒ A summary of the estimated volumes in cubic feet of each solid mixed waste type summarized in Line 1 above, and in liters for each liquid mixed waste

[See Appendix C of this Decommissioning Plan for additional information]

☒ A summary of the radionuclides (including the estimated activity of each radionuclide) in each type of mixed waste type summarized in Line 1 above

[See Appendix C of this Decommissioning Plan for additional information]

The solid LLMW identified above, met the requirements of waste radioactive material, Low Specific Activity (LSA-1), class 7.

☒ A summary of the estimated volumes of Class A, B, C, and Greater-than-Class-C mixed waste that will be generated by decommissioning operations

[See Appendix C of this Decommissioning Plan for additional information] No Class B, C, or Greater than Class C mixed waste was generated during the Lead Cascade decommissioning efforts.

☒ A description of how and where each of the mixed wastes summarized in Line 1 above will be stored onsite prior to shipment for disposal

Prior to shipment to the disposal site, solid LLMW was stored onsite in an area approved for radioactive material within the MBA and also approved and designated as a 90-day storage area for hazardous waste.

☒ A description of how the each of the mixed wastes summarized in Line 1 above will be treated and packaged to meet disposal site acceptance criteria prior to shipment for disposal

☒ The name and location of the disposal facility that the licensee intends to use for each mixed waste type summarized in Line 1 above

The solid LLMW generated during Lead Cascade decommissioning efforts was shipped off site to a treatment facility which macro encapsulated the waste prior to being shipped for final disposal at NNSS. [See Appendix C of this Decommissioning Plan for additional information]

☒ A discussion of the requirements of all other regulatory agencies having jurisdiction over the mixed waste

No other agencies have jurisdiction over the solid LLMW at the Lead Cascade.

☒ A demonstration that the licensee possesses the appropriate EPA or State permits to generate, store, and/or treat the mixed wastes

Currently, the Lead Cascade is an Ohio EPA conditionally exempt small quantity generator. Storage of the hazardous waste with respect to the EPA requirements is defined within currently approved procedures and processes. No treatment will be performed at the Lead Cascade; therefore, no permits are needed.

XIII. QUALITY ASSURANCE PROGRAM

XIII.a. ORGANIZATION

☒ A description of the QA program management organization

As described in Section 1.0 of the Quality Assurance Program Description (QAPD) and Chapter 2.0 of the License Application, the Senior Vice President, Field Operations has overall responsibility for the safe operation and decommissioning of the Lead Cascade. The Senior Vice President, Field Operations has designated the Director, American Centrifuge Project Quality Assurance, the responsibility for ensuring the project achieves its quality targets and meets its regulatory driven quality commitments. The Quality Assurance Manager reports to the Director, American Centrifuge Project Quality Assurance and is responsible for independent oversight of American Centrifuge Program activities covered by the QAPD. This includes maintenance and programmatic administration of the QAPD, policies, and procedures, and for assessing its effective implementation. The QA Manager interacts directly with the line management for QA matters through a dotted line reporting to the General Manager, American Centrifuge Plant Operations and Decommissioning, but is independent from production, plant operating costs, and production schedule concerns.

☒ A description of the duties and responsibilities of each unit within the organization and how delegation of responsibilities is managed within the decommissioning program

Duties and responsibilities of each function within the Lead Cascade organizational structure are further described in Section 1.0 of the QAPD and Chapter 2.0 of the License Application. Additionally, specific organizational responsibilities are defined in the currently approved operating procedures developed and implemented in accordance with Section 5.0 of the QAPD.

Minimum qualifications, functions, and responsibilities for key staff positions are described in Chapter 2.0 of the License Application. These key staff positions have substantive breadth and level of experience in their areas of expertise to successfully execute their responsibilities. These key staff positions are available as necessary to provide timely support in their respective functional area. Alternates are designated in writing and in accordance with approved procedural requirements to fulfill the responsibilities and authorities of these key staff positions during their absence.

☒ A description of how work performance is evaluated

Planned audits are performed by the QA organization to verify compliance with the aspects of the QA program and to determine its effectiveness. The QAPD and supporting documents describe the requirements for evaluating work performance. These requirements are flowed down into currently approved QA-specific procedures.

☒ A description of the authority of each unit within the QA program

The authorities of each function within the Lead Cascade organizational structure are described in Section 1.0 of the QAPD and Chapter 2.0 of the License Application.

☒ An organization chart of the QA program organization

See Section IX of this Decommissioning Plan for the complete Lead Cascade organizational structure.

XIII.b. QUALITY ASSURANCE PROGRAM

☒ A commitment that activities affecting the quality of site decommissioning will be subject to the applicable controls of the QA program and activities covered by the QA program are identified on program defining documents

Activities affecting the quality of the Lead Cascade decommissioning efforts will be subject to the existing applicable controls of the QA program. These activities will be performed following the guidance of the currently approved QAPD and the Graded Approach to Configuration Management and Quality Assurance.

☒ A brief summary of the company's corporate QA policies

The QAPD establishes the policy requirements approved by the Senior Vice President, Field Operations. The Licensee describes and commits to its QA policies as described in the QAPD and supporting documents. As described in Section 2.0 of the QAPD, the QA elements are applied to the design, refurbishment/construction, manufacturing, testing, start-up, operation, procurement, inspection, maintenance, modification, and decommissioning of IROFS, and activities affecting those IROFS, to ensure they will be available and reliable to perform their safety function when needed. The QAPD is applied to IROFS in a graded approach to an extent commensurate with their importance to safety.

☒ A description of provisions to ensure that technical and quality assurance procedures required to implement the QA program are consistent with regulatory, licensing, and QA program requirements and are properly documented and controlled

Section 11.4 of the License Application describes the management controls for the development, issuance, and control of currently approved operating procedures. The procedure process utilizes a graded approach to provide the necessary rigor for safe Lead Cascade operation, assure the Licensee's commitments to meeting regulations and standards, and assure a balance of effective safety with practical efficiency in facility operations.

Additionally, as described in Section 5.0 of the QAPD, the QAPD establishes the policy requirements approved by the Senior Vice President, Field Operations. Procedures are the second tier of documents that implement the QAPD. Procedures written for the QA program are subject to the review and approval process described in currently approved operating procedures. The QA organization reviews QA implementing procedures for compliance and consistency with the QAPD. QA review of procedures is performed to ensure that the provisions of the QAPD are effectively incorporated into QA implementing procedures.

☒ A description of the management reviews, including the documentation of concurrence in these quality-affecting procedures

The procedure process utilizes nine basic elements to accomplish procedure development, review, approval, and control: identification, development, review and comment resolution, verification, validation, approval, issuance, change control, and periodic review. These nine elements are discussed in detail within Section 11.4 of the License Application and are implemented through currently approved operating procedures.

As discussed in Section 11.4.4.3 of the License Application, drafts of new procedures and procedure changes are distributed for technical reviews, safety discipline reviews (e.g., nuclear criticality, fire, radiation, industrial, and chemical process safety), and cross-discipline reviews, as needed. Comments/questions generated during the review process are resolved with the originating organizations. 10 CFR 70.72 and intent/non-intent screenings are performed for new and changed procedures (except minor administrative changes that are processed according to the currently approved procedure process). In addition, the Facility Safety Review Committee will review:

- Each new procedure required by Section 11.4.4.1 of the License Application, and
- Each proposed change to procedures required by Section 11.4.4.1 of the License Application if the proposed change constitutes an intent change (i.e., a change in scope, method, or acceptance criteria that has safety significance).

As discussed in Section 11.4.7 of the License Application, records generated during procedure use are identified in the approved governing procedure and controlled according to the currently approved Records Management Document Control (RMDC) program practices as described in Section 11.7 of the License Application.

☒ A description of the quality-affecting procedural controls of the principal contractors

Section 7.0 of the QAPD describes the control of purchased items and services to assure conformance with specified requirements. These controls provide for the following, as appropriate: source evaluation and selection; evaluation of objective evidence of quality furnished by the supplier; source inspection; audit; and examination of items or services upon delivery or completion. Additionally, supplier selection is based, in part, on a pre-

award evaluation of capability to provide items or services in accordance with the requirements of procurement documents. The evaluation techniques are described in Section 7.3 of the QAPD. Suppliers with acceptable technical, quality, and commercial qualifications are placed on the Approved Suppliers List (ASL) maintained by the QA organization. Retention on the list is based on performance. Suppliers not pre-qualified may be used with appropriate compensatory controls as agreed upon by the QA organization. Currently approved operating procedures describe the processes of evaluating suppliers, providing them with information, evaluating their products and services, and providing corrective actions to improve performance when discrepancies are discovered.

☒ A description of how NRC will be notified of changes (a) for review and acceptance in the accepted description of the QA program as presented or referenced in the DP before implementation and (b) in organizational elements within 30 days after the announcement of the changes

As described in Section 11.1.1 of the License Application, in accordance with 10 CFR 70.72, a Configuration Management program is implemented to ensure that changes from the Lead Cascade baseline configuration are identified and controlled to help ensure safety through consistency among the facility design and operational requirements, the physical configuration, and the facility documentation. Additionally, as conditioned by the NRC's Materials License, a change to the facility or its processes is evaluated before the change is implemented. The evaluation of the change determines, before the change is implemented, whether an application for an amendment to the license application is required to be submitted in accordance with 10 CFR 70.34. As discussed in Section 19.0 of the QAPD, changes not requiring NRC approval prior to implementation will be submitted to the NRC annually, in accordance with 10 CFR 70.72.

Currently approved operating procedures establish the process for the evaluation of changes to the site, structures, processes, systems, equipment, components, computer programs, and activities of personnel to determine if a change requires NRC approval before implementation.

☒ A description is provided of how management regularly assesses the scope, status, adequacy, and compliance of the QA program

Section 11.5 of the License Application and Section 18.0 of the QAPD discuss the implementation of a system of audits and assessments to help ensure that the health, safety, and environmental programs, as described in the License Application, are adequately and effectively implemented. The system of audits and assessments is designed to ensure comprehensive independent program oversight at least once every three years. Planned and scheduled audits are performed by the QA organization in accordance with currently approved operating procedures or checklists to verify compliance with the aspects of the QA program and to determine its effectiveness. Management responsible for implementing portions of the QAPD perform assessments to verify the adequacy of the

portion of the QAPD for which they are responsible, and to assure its effective implementation.

☒ A description of the instruction provided to personnel responsible for performing activities affecting quality

As discussed in Section 2.0 of the QAPD, indoctrination and training of personnel performing or managing activities affecting quality will meet the requirements of Part 1 of American Society of Mechanical Engineers (ASME) Nuclear Quality Assurance (NQA)-1—1994, Supplement 2S-4, *Supplementary Requirements for Personnel Indoctrination and Training*. Each manager is responsible for the applicable indoctrination, training, and qualification of their personnel.

Additionally, Section 11.3 of the License Application describes the management measures specific to training and qualifications of personnel who perform activities relied on for safety. These personnel are tested, as necessary, to ensure that they are qualified on practices important to public safety and worker safety, safeguards of licensed material, and protection of the environment. Currently approved operating procedures govern the development and implementation of training programs.

☒ A description of the training and qualifications of personnel verifying activities affecting quality in the principles, techniques, and requirements of activities being performed

As discussed in Section 2.0 of the QAPD, Quality Control personnel performing inspection and testing will meet the requirements of Part 1 of ASME NQA-1—1994, Supplement 2S-1, *Supplementary Requirements for the Qualification of Inspection and Test Personnel.* Additionally, QA audit personnel will meet the requirements of ASME NQA-1—1994, Part 1, Supplement 2S-3, *Supplementary Requirements for the Qualification of Quality Assurance Program Audit Personnel.*

Currently approved operating procedures define the policy for qualifying Quality Control personnel who perform inspection and testing to verify conformance to specified requirements for acceptability, as well as providing guidance for meeting the requirements of the qualification process for individuals who perform internal independent audits or external supplier audits for the Lead Cascade.

☒ For formal training and qualification programs, documentation includes the objectives and content of the program, attendees, and date of attendance

The Training Manager is responsible for establishing procedures governing the development and implementation of training programs as defined in Section 11.3 of the License Application. Additionally, the Lead Cascade functional organizational managers are responsible for defining the job-specific training needs and ensuring completion of training and qualification for personnel within their organization. Workers relied upon to

design, operate, or maintain IROFS are trained and evaluated for qualification prior to assignment of these duties. Task or duty area qualification is granted by line management based on successful evaluation of the worker's mastery of the learning objectives presented during training. Maintenance of qualification is contingent upon successful completion of continuing training and/or through satisfactory on-the-job training evaluations.

Currently approved operating procedures direct the development, review, and approval of training objectives and content. Attendance sheets showing attendees, courses, instructors, locations, dates, and times are available for completed training. Training materials are available to employees on the Licensee's EDMS as defined within the Records Management program.

☒ A description of the self-assessment program to confirm that activities affecting quality comply with the QA program

As previously discussed, the system of audits and assessments is designed to ensure comprehensive independent program oversight at least once every three years. As discussed in Section 11.5.2 of the License Application, management responsible for implementing portions of the QAPD perform assessments to verify the adequacy of the portion of the QAPD for which they are responsible and to assure its effective implementation. Organization managers maintain an assessment process within their organization to assess the adequacy and effectiveness of the implementation of the programs under their cognizance. Currently approved operating procedures provide direction for conducting management assessments of programs, processes, and areas associated with the Lead Cascade.

☒ A commitment that persons performing self-assessment activities are not to have direct responsibilities in the area they are assessing

As discussed in Section 11.5.1 of the License Application and Section 18.0 of the QAPD, audits are conducted by the QA organization in accordance with written procedures or checklists by qualified auditors. The auditing organizations are independent from operations of the Lead Cascade. Audits are performed under the direction of a Lead Auditor, qualified in accordance with ASME NQA-1, Supplement 2S-3. Lead auditors and staff auditors are functionally and organizationally independent of the programs and activities examined. Where appropriate, audit teams are supplemented with facility and/or external technical specialists. Currently approved operating procedures define the QA internal independent audits and assessments program.

☒ A description of the organizational responsibilities for ensuring that activities affecting quality are (a) prescribed by documented instructions, procedures, and drawings and (b) accomplished through implementation of these documents

As described in Section 5.0 of the QAPD, activities affecting the availability and/or reliability of IROFS are prescribed by and accomplished according to documented

procedures, instructions, and drawings of a type appropriate to the circumstances. These documents include or reference appropriate acceptance criteria for determining prescribed activities have been satisfactorily accomplished. Standard guidelines for the format, content, and review and approval processes are established in accordance with the procedure process defined within Section 11.4 of the License Application.

Lead Cascade organization managers have the responsibility for identifying which tasks will be proceduralized within their areas of control, using the criteria defined within Section 11.4 of the License Application and implemented through currently approved operating procedures. As a minimum, procedures are required for:

- The operation of IROFS and the management measures supporting those IROFS as identified in the ISA Summary
- Operator actions necessary to prevent or mitigate the consequences of accidents described in the ISA Summary
- Safe work practices to control processes and operations with special nuclear material, IROFS, and/or hazardous chemicals incident to the processing of licensed material

☒ A description of the procedures to ensure that instructions, procedures, and drawings include quantitative acceptance criteria and qualitative acceptance criteria for determining that important activities have been satisfactorily performed

As discussed in Section 11.4 of the License Application, a management controls program has been established for the development, issuance, and control of Lead Cascade procedures. The Lead Cascade employees are committed to the use of approved and controlled written procedures to conduct nuclear safety, safeguards, and security activities for the protection of the public, facility employees, and the environment. Procedures are used to ensure safe work practices and apply to workers, visitors, contractors, and vendors. The procedure process utilizes a graded approach to provide the necessary rigor for safe Lead Cascade operation, assure the Licensee's commitments to meeting regulations and standards, and assure a balance of effective safety with practical efficiency in facility operations. Procedures are intended to prescribe those essential actions or steps needed to safely and consistently perform operations and maintenance activities.
Additionally, as discussed in Section 5.0 of the QAPD, the QAPD establishes the policy requirements approved by the Senior Vice President, Field Operations. Procedures are the second tier of documents that implement the QAPD. Third tier instructions provide specific step-by-step directions when deemed necessary. Procedure and instruction preparation, review, and approval are the responsibility of the applicable manager. The QA organization reviews QA implementing procedures for compliance and consistency with the QAPD. QA review of procedures is performed to ensure that the provisions of the QAPD are effectively incorporated into QA implementing procedures.

XIII.c. DOCUMENT CONTROL

☒ A summary of the types of QA documents that are included in the program
☒ A description of how the licensee develops, issues, revises, and retires QA documents

As described in Section 11.7.2 of the License Application, the Document Control program provides direction for the handling, distribution, and transmittal of documents important to nuclear safety and safeguards and security which specify quality requirements or prescribe activities affecting quality, such as procedures, drawings, and calculations. This program is implemented through currently approved operating procedures providing guidance on the program elements, such as approval and release of documents; controlled document index and distribution lists; distribution; and voided, canceled, or superseded documents.

Additionally, Section 11.7.5 of the License Application provides a listing of examples of records by each chapter of the license application. Pursuant to 10 CFR 70.25(g), the Licensee will keep records until the termination of the NRC Materials License of information which could have a material effect on the ultimate costs of decommissioning. Specifically, as described in Section 10.7 of the License Application, records important for safe and effective decommissioning of the facility are maintained in accordance with established RMDC procedural requirements.

XIII.d. CONTROL OF MEASURING AND TEST EQUIPMENT

☒ A summary of the test and measurement equipment used in the program

As described in Section 11.2.8 of the License Application and Section 12.0 of the QAPD, the Maintenance program provides direction for requirements of Measuring and Test Equipment (M&TE) used in activities affecting the availability and/or reliability of IROFS to be properly controlled, calibrated, and adjusted, if necessary, at specified intervals to maintain equipment performance within required limits.

At present, there are approximately 121 pieces (e.g., torque wrenches, electrical test gear, and pressure test gear, etc.) of M&TE listed in the inventory program. Currently, due to shut down of operations, many of these pieces have been taken out of service and more will follow as the need for such equipment is reduced; less than twenty are in service at present.

☒ A description of how and at what frequency the equipment will be calibrated

Currently approved operating procedures ensure that devices and standards used for measurement, tests, and calibration activities are of the proper type, range, and accuracy, as described in Section 11.2.8 of the License Application. M&TE is calibrated at specified intervals or prior to use against equipment having a known valid relationship to nationally recognized standards. Standards are certified and traceable to the NIST. If no national

standard exists, the basis for calibration is documented and approved by the Engineering Organization. M&TE is properly handled and stored to maintain accuracy.

When M&TE is found to be out of calibration, as-found data are recorded and an evaluation is made and documented as to the validity of previous inspection and test results and of the acceptability of items previously inspected or tested. Out-of-calibration devices are tagged or segregated and are not used until re-calibrated. When M&TE is consistently found to be out of calibration, it is repaired or replaced. Also, calibrations are performed when personnel performing measurements and tests deem the accuracy of the equipment suspect.

☒ A description of the daily calibration checks that will be performed on each piece of test or measurement equipment

Daily calibration of mechanical M&TE is not performed under this program. Each piece of M&TE is assigned a unique identifier and labeled to identify calibration/certification status. These individual pieces are listed and scheduled for calibration checks through the FaciliWorks scheduling system. All equipment is scheduled for annual checks, except for Vacuum Calibrators which were checked semi-annually.

Electrical and instrument calibrating equipment go through a verification process prior to use on a known existing voltage and pressure range to verify they are functional. If issues are found, equipment is removed from service until those issues are corrected.

☒ A description of the documentation that will be maintained to demonstrate that only properly calibrated and maintained equipment was used during the decommissioning

Calibration records are maintained and equipment is suitably marked or otherwise identified to indicate its calibration status as described in Section 12.3 of the QAPD. Along with the FaciliWorks records for calibration, the specific calibration paperwork is also kept in the M&TE storage room in a 1-hour fire rated container as specified within the currently approved Records Management Process. As described in currently approved operating procedures, Use Logs are maintained with each piece of M&TE to record date and purpose of use. These logs, along with the identification sticker applied to the equipment, give the user the proper use range and date to ensure the equipment is current on its calibration. M&TE is stored separately from other equipment to minimize the possibility of damage that could affect its reliability. M&TE determined to be out of tolerance during calibration is identified and an investigation is conducted of equipment used since the previous calibration.

QA records are maintained in accordance with Section 17.0 of the QAPD and Section 11.7 of the License Application.

XIII.e. CORRECTIVE ACTION

☒ A description of the corrective action procedures for the facility, including a description of how the corrective action is determined to be adequate

As discussed in Section 11.6.7 of the License Application, for each significant condition adverse to quality or reportable event where a follow-up written report to the NRC is required, corrective actions to prevent recurrence are developed by responsible management, tracked in a database, and monitored through completion in accordance with the corrective action program. Corrective actions are taken within a reasonable period, commensurate with the safety significance of the event. The plant's approved Corrective Action Process procedure guides the processing of identified issues or events and includes direction on contributing and root cause determination, development of corrective actions to prevent recurrence of issues, and management measures to ensure corrective action adequacy.

As discussed in Section 11.6 of the License Application, Incident Investigation encompasses the identification, reporting, and investigation of abnormal events or conditions, including precursor events that may occur. This includes identification and categorization of the incident, as well as an analysis to determine the specific or generic causes, as well as generic implications. Pursuant to 10 CFR 70.50 and 70.74, the Licensee will notify the NRC of certain facility events and conditions and determine the root cause of the event, including all factors which contributed to the event, and the manufacturer and model number (if applicable) of any equipment that failed or malfunctioned. Corrective actions taken or planned to prevent occurrence of similar or identical events in the future, and the results of any evaluations or assessments to determine adequacy of correction actions, must also be provided.

The Licensee satisfies these requirements by approved operating procedures relating to incident identification and reporting. These procedures work together to ensure abnormal events and conditions occurring at the facility are promptly reported to appropriate Lead Cascade personnel, assessed, and when required, reported to the NRC Operations Center or designated NRC office.

☒ A description of the documentation maintained for each corrective action and any follow-up activities by the QA organization after the corrective action is implemented

Evidence files used to support action closure are maintained in accordance with approved operating records management procedures. As defined within the approved operating procedure for the Corrective Action Process, the Web-based Corrective Actions Tracking System (CATSWeb) database is considered the quality record. Evidence documentation is to be attached or linked (only from American Centrifuge electronic systems) to the appropriate Action/Subtask for conditions adverse to quality as well as significant conditions adverse to quality.

As discussed in Section 11.5 of the License Application and in accordance with approved operating procedures, audits and assessments of incident investigations are conducted to ensure adequate and effective implementation. Section 18.1 of the Quality Assurance Program Description (QAPD) states in part during internal audits, follow-up action is taken by the QA organization to verify the implementation and effectiveness of the corrective actions and to determine if repetitive problems require further corrective action in accordance with Section 16.0 of the QAPD. Section 16.0 of the QAPD explains conditions adverse to quality are identified and corrected promptly. In the case of a significant condition adverse to quality, the cause of the condition is determined, and corrective action is taken to preclude recurrence. Significant conditions, their causes, and corrective actions are documented, reported to appropriate levels of management, and follow-up action is taken to verify implementation of corrective actions.

XIII.f. QUALITY ASSURANCE RECORDS

☒ A description of the manner in which the QA records will be managed

As discussed in Section 17.0 of the QAPD, the QA records system ensures records are specified, prepared, and maintained in a manner to provide protection and retrievability. The Records Management program provides direction for the handling, transmittal, storage, and retrievability of records. Specifically, Section 11.7.1 of the License Application describes the manner in which the QA records will be managed. This program is implemented through currently approved operating procedures that provide guidance for the program elements.

☒ A description of the responsibilities of the QA organization

As discussed in Section 11.5 of the License Application and Section 18.0 of the QAPD, an implemented system of audits and assessments is designed to ensure comprehensive independent oversight of the QA Program at least once every three years. The system is comprised of two distinct levels of activities: 1) audits and 2) assessments. Both audits and assessments are conducted in accordance with approved operating procedures for the area of records management to ensure adequate and effective implementation of the management measure. Adequacy of audit responses is evaluated by the QA organization and verification of corrective action is documented. Follow-up action is taken by the QA organization to verify the implementation and effectiveness of the corrective actions and to determine if repetitive problems require further corrective action in accordance with Section 16.0 of the QAPD.

☒ A description of the QA records storage facility

As discussed in Section 17.0 of the QAPD, storage facilities protect against the risk of loss or deterioration of lifetime records as defined in accordance with ASME NQA-1 – 1994, Supplement 17S-1, Section 2.7.1, *Supplementary Requirements for Quality Assurance Records*. Storage facilities are maintained to ensure continuous protection of records.

Section 11.7.1.8 of the License Application describes the storage requirements for both permanent and temporary storage of QA records. These storage requirements are implemented by currently approved operating procedures.

According to currently approved operating procedures, RMDC currently utilizes both a classified and an unclassified EDMS to manage documents and records. Additionally, electronic records entered into CATSWeb are not required to be transmitted to RMDC since the database is considered to be the quality record.

XIII.g. AUDITS AND SURVEILLANCES

☒ A description of the audit program

Section 11.5 of the License Application and Section 18.0 of the QAPD describe an implemented system of audits and assessments designed to ensure comprehensive independent oversight of the QA Program at least once every three years (except as noted below). The system is comprised of two distinct levels of activities: 1) audits and 2) assessments. Both audits and assessments are conducted in accordance with approved operating procedures.

Specifically, Section 11.5.1 of the License Application describes that audits are conducted by the QA Organization in accordance with currently approved operating procedures or checklists by qualified auditors. The auditing organizations are independent from operations of the Lead Cascade. Audits verify the effectiveness of health, safety, and environmental programs and their implementation and determine the effectiveness of the process being assessed. Audits further verify that Lead Cascade operations are being conducted safely in accordance with regulatory requirements and license application commitments, and the ISA.

Audits and their associated frequencies are conducted in accordance with Section 18.0 of the QAPD and use currently approved operating procedures or checklists. Audits are performed under the direction of a Lead Auditor, qualified in accordance with the ASME NQA-1, Supplement 2S-3. Lead Auditors and staff auditors are functionally and organizationally independent of the programs and activities that are examined. Where appropriate, audit teams are supplemented with facility and/or external technical specialists.

In addition to periodically evaluating aspects of the QAPD, audits are conducted for the areas of radiation safety, nuclear criticality safety (every two years), chemical safety, fire safety, environmental protection, emergency management, quality assurance, CM, maintenance, training and qualification, procedures, incident investigation, records management, nuclear safety, security (every two years), and operations.

☒ A description of the records and documentation generated during the audits and the manner in which the documents are managed

As described in Section 11.5.1 of the License Application and Section 18.1 of the QAPD, audit results are documented and reported to Lead Cascade senior management as specified in currently approved operating procedures. The audit report includes the following information, as appropriate:

- Description of the audit scope;
- Identification of the auditors;
- Identification of persons contacted during audit activities;
- Summary of audit results, including a statement on the effectiveness of the QA program elements audited; and
- Description of each reported adverse audit finding in sufficient detail to enable corrective action to be taken by the audited organization.

Audit records include audit plans, audit reports, corrective action documentation, and the record of completion of corrective actions. The audit records are maintained in accordance with currently approved operating procedures that flow down the requirements as discussed in Section 11.7 of the License Application and Section 17.0 of the QAPD. RMDC programs are designed to meet the specific record keeping and document control requirements set forth in 10 CFR Part 70 and the applicable provisions of other parts of 10 CFR.

☒ A description of all follow-up activities associated with audits or surveillances

As described in Section 11.5.1 of the License Application and Section 18.0 of the QAPD, management of the audited organization or activity investigates adverse audit findings, and documents and schedule corrective action, including measures to prevent recurrence. Adequacy of audit responses is evaluated by the QA organization and verification of corrective action is documented. Follow-up action is taken by the QA organization to verify the implementation and effectiveness of the corrective actions and to determine if repetitive problems require further corrective action in accordance with Section 16.0 of the QAPD.

☒ A description of the trending/tracking that will be performed on the results of audits and surveillances

As described in Section 16.0 of the QAPD, conditions adverse to quality are identified and corrected promptly. In the case of a significant condition adverse to quality, the cause of the condition is determined, and corrective action is taken to preclude recurrence. Significant conditions, their causes, and corrective actions are documented, reported to appropriate levels of management, and follow-up action is taken to verify implementation of corrective actions. Additional requirements associated with corrective actions are found in Section 11.6.7 of the License Application.

In accordance with the currently approved corrective action procedure, audit and assessment findings are entered into CATSWeb as a CN and each is assigned a trend classification. In addition to routine Corrective Action program monitoring by the Regulatory organization, the Corrective Action Review Team (CART) periodically reviews CNs for proper disposition, significance level, and trend identification. On a periodic basis, CART reviews CN trend data to identify any adverse trends or other items of regulatory importance or safety significance.

XIV. FACILITY RADIATION SURVEYS

XIV.a. RELEASE CRITERIA

☒ A summary table or list of the $DCGL_W$ for each radionuclide and impacted media of concern

☒ If Class 1 survey units are present, a summary table or list of area factors that will be used for determining a $DCGL_{EMC}$ for each radionuclide and media of concern

☒ If Class 1 survey units are present, the $DCGL_{EMC}$ values for each radionuclide and medium of concern

☒ If multiple radionuclides are present, the appropriate $DCGL_W$ for the survey method to be Used

The $DCGL_W$ as calculated using the RESRAD-BUILD modeling software results is 50,000 dpm/100 cm^2. The single nuclide of concern is Uranium, in the form of Class D compounds and the proposed $DCGL_W$ is acceptable for the assays of uranium encountered at the Lead Cascade. The media of concern is the concrete floor areas. See Section V.b of this Decommissioning Plan for a detailed discussion on the $DCGL_W$ calculation. As described in Section V.b of this Decommissioning Plan, while the $DCGL_W$ is 50,000 dpm/100 cm^2, the Lead Cascade License Application states the release limit for total alpha contamination is 5,000 dpm/100 cm^2, therefore this limit will be used for releasing areas for unrestricted use.

Scoping survey data indicated two small areas that required remediation. Both areas were significantly less than the 100 m^2 area defined in MARSSIM. These two areas were designated as Class I areas. Survey data collected after remediation indicated residual contamination levels are less than the release limits identified in the Lead Cascade License Application Section 4.0.

$DCGL_{EMC}$ (Elevated Measurement Comparison)

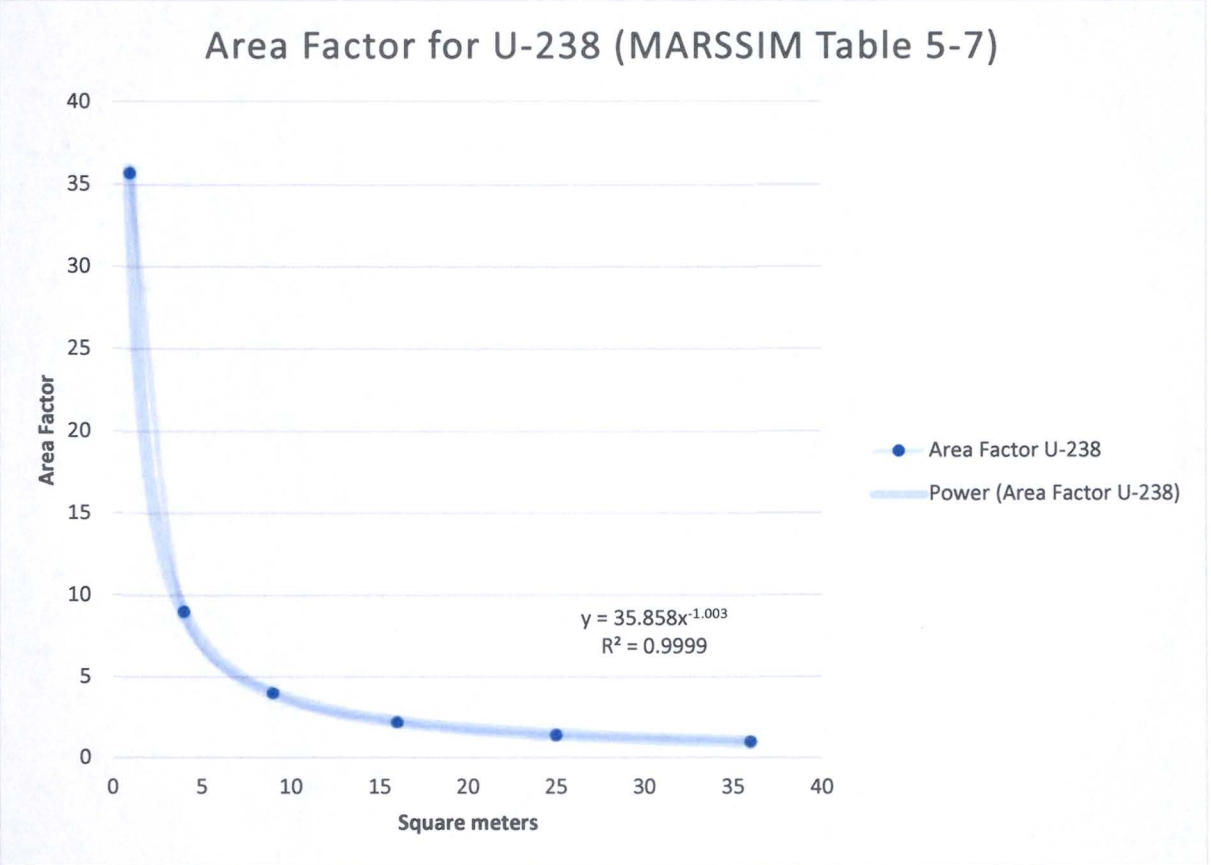
The $DCGL_{EMC}$ is 191,231 dpm/100 cm^2 and is based on an Area Factor (AF) of 3.8246. The single nuclide of concern is Uranium, in the form of Class D compounds and a naturally occurring assay. The media of concern is the concrete floor areas. There are no other nuclides of concern present. Below is a discussion on the development of the $DCGL_{EMC}$.

To determine the $DCGL_{EMC}$, the AF is used to adjust $DCGL_W$ and the minimum detectable concentration for scanning surveys in Class I survey units. AF is the magnitude that residual activity in a small area of elevated activity can exceed the $DCGL_W$ and still meet the 25 mrem criteria.

$$DCGL_{EMC} = DCGL_W \times AF$$

The area factor for the two Class I survey units in X-3001 building is based on the data for ^{238}U from MARSSIM Table 5-7 Illustrative Examples of Indoor Area Dose Factors. The table values were plotted in Microsoft Excel. The graphical representation is shown in Table XIV.a-1 below:

Table XIV.a-1 Plot of MARSSIM Table 5-7 Data



The resulting equation was then used to extrapolate the AF for the area with elevated activity.

$$AF = 35.858 \times \text{Area of Elevated Activity}^{-1.003}$$

The area of elevated activity for the two Class 1 survey units located in the X-3001 building is 9.313 m^2. Therefore:

$$AF = 35.858 \times 9.313^{-1.003} = 3.8246$$

This yields a $DCGL_{EMC}$ of:

$$DCGL_{EMC} = 50{,}000 \text{ dpm}/100 \text{ cm}^2 \times 3.8246 = 191{,}231 \text{ dpm}/100 \text{ cm}^2$$

To ensure that no additional sampling points were required, the Scan Minimum Detectable Concentration (MDC) (see Table XIV.c-1 of this Decommissioning Plan) was determined for the selected scanning technique and compared to the $DCGL_{EMC}$.. The Scan MDC_{actual} for the scanning technique using a Floor Monitor is 1,786 dpm/100 cm^2 beta and 1,594 dpm/100 cm^2 alpha. Since Scan $MDC_{actual} < DCGL_{EMC}$, no additional sampling points are necessary for the elevated activity area survey.

Using the estimated size of the Class I area located in Train 2 Utility Bay at the Lead Cascade (roughly 9 m^2), the calculations for determining the $DCGL_{EMC}$ are shown assuming a triangular grid spacing (L), 9 data points, and a $DCGL_W$ of 50,000 dpm/100 cm^2.

$$L = \sqrt{\frac{9}{0.866x9}} = 1.075\ m^2$$

$$AF = 35.858x9.313^{-1.003} = 33.3619$$

$$DCGL_{EMC} = 50{,}000\ x\ 33.3619 = 1{,}668{,}097\ \ dpm/100\ cm^2$$

It is estimated that the scanning MDC (discussed later) using a Floor Monitor is 1786 dpm/100 cm^2 beta and 1,594 dpm/100 cm^2 alpha.

The $DCGL_{EMC}$ values listed in the RESRAD-BUILD Results tables were made assuming a sample size of 9, a triangular grid survey performed in a 676.4 m^2 Survey Unit, and the 3.8246 area factor. A $DCGL_{EMC}$ of 191,230 dpm/100cm^2 for small areas of 9.313 m^2 with elevated contamination would meet the 25 mrem criteria.

$$L = \sqrt{\frac{676.4}{0.866\ x\ 9}} = 9.313\ m^2$$

$$AF = 35.858\ x\ 9.313^{-1.003} = 3.8246$$

$$DCGL_{EMC} = 50{,}000\ x\ 3.8246 = 191{,}230\ \ dpm/100\ cm^2$$

However, this level of contamination (50,000 dpm/100 cm^2) does not meet commitments made in Chapter 4.0 of the License Application. Table 4.8-1 of the License Application would require posting the area as a Fixed Contamination Area (see excerpt from Table 4.8-1).

Therefore, the Licensee proposes using 5,000 dpm/100 cm^2 as the basis for performing the final status survey.

Using MARSSIM criteria (formula 5-1) the minimum number of sample locations to ensure that any elevated areas of contamination would be identified and sufficient data for statistical analysis in the Survey Unit are shown below in Table XIV.a-2. This table was developed using the Utility Bay Scoping Survey data performed in 2015.

Table XIV.a-2 Sample Size Determination

DCGL	410	α cpm for 5,000 dpm α
LBGR	205	Set to 50 percent of DCGL
Δ	205	
UB Std Dev	28.67	Scoping Survey Data
Δ/α	7.15	Relative Shift – UB
P_r	1.000000	Probability Table 5.1 - UB
$Z_{1-\alpha}$	1.645	α and β = 0.05 Table 5.2
$Z_{1-\beta}$	1.645	α and β = 0.05 Table 5.2
$Z_{1-\alpha}$	1.96	α and β = 0.025 Table 5.2
$Z_{1-\beta}$	1.96	α and β = 0.025 Table 5.2
$N_{(0.05)}$	17	Trains 2 and 3 Utility Bays
$N_{(0.025, 0.05)}$	21	Trains 2 and 3 Utility Bays
$N_{(0.05)}$	9	Trains 2 and 3 Utility Bays
$N_{(0.025, 0.05)}$	10	Trains 2 and 3 Utility Bays

The data from the scoping surveys suggest that contamination at the Lead Cascade is localized and not "normally" distributed and contamination levels are expected to be significantly less than the proposed $DCGL_W$ (or 50,000 dpm/100 cm^2). A Nonparametric Tolerance Limit method that is independent of the distribution to estimate the average contamination levels with 95/95 percent confidence would require a minimum of 59 sample locations for a large area (i.e., X-3001 building Train 3).

Adjusting the Lower Band of the Gray Region (LBGR) to roughly 85 percent of the DCGL would indicate 12 to 15 sample locations would be required, see Table XIV.a-3 below. 15 samples locations are in line with the statistical approach used during the 2004 baseline survey to estimate the average contamination levels in the GCEP facilities.

Table XIV.a-3 Adjusting LBGR to Obtain Acceptable Relative Shift

DCGL	410	α cpm for 5,000 dpm α
LBGR	349	Set to 85 percent of DCGL
Δ	62	
UB Std Dev	28.67	Scoping Survey Data
Δ/α	2.14	Relative Shift – UB
P_r	0.921319	Probability Table 5.1 - UB
$Z_{1-\alpha}$	1.645	α and β = 0.05 Table 5.2
$Z_{1-\beta}$	1.645	α and β = 0.05 Table 5.2
$Z_{1-\alpha}$	1.96	α and β = 0.025 Table 5.2
$Z_{1-\beta}$	1.96	α and β = 0.025 Table 5.2
$N_{(0.05)}$	24	Trains 2 and 3 Utility Bays
$N_{(0.025, 0.05)}$	29	Trains 2 and 3 Utility Bays
$N_{(0.05)}$	12	Trains 2 and 3 Utility Bays
$N_{(0.025, 0.05)}$	15	Trains 2 and 3 Utility Bays

Using 15 sample locations rather than 9, a triangular grid survey performed in a 676.4 m^2 Survey Unit, a grid spacing of 7.2 m^2, and a 4.94 area factor; a $DCGL_{EMC}$ of 24,706 dpm/100 cm^2 was derived. The required scan MDC to reliably detect the $DCGL_{EMC}$ of uranium alpha is estimated to be roughly 20,000 dpm/100 cm^2.

Based on known radiological conditions at the Lead Cascade, contamination levels exceeding the calculated $DCGL_W$ are not expected. Therefore, $DCGL_{EMC}$ evaluations during the Lead Cascade Final Status Survey are not anticipated. In addition, the areas at the Lead Cascade that meet the definition of a Class I area are less than grid spacing for a Class II survey.

XIV.b. CHARACTERIZATION SURVEYS

☒ A description and justification of the survey measurements for impacted media

As discussed in Section II of this Decommissioning Plan, a Baseline Survey was conducted in 2004 using a survey plan approved by DOE to establish the radiological conditions of the Lead Cascade buildings/facilities before the Lead Cascade activities commenced such that should these conditions change due to these activities, these changes could be quantified by a future survey. In 2015, the Licensee conducted a scoping survey to determine if there had been any changes from the Baseline Survey. Using the same techniques that had been approved by DOE for the Baseline Survey, this scoping survey identified only two locations in the X-3001 building where contamination above the Baseline Survey was detected. These areas have since been remediated.

The Licensee considers the Scoping Survey describe above to be the equivalent of a characterization survey discussed in this section of the Decommissioning Plan.

☒ A description of the field instruments and methods that were used for measuring concentrations and the sensitivities of those instruments and methods

See the previous discussion within Section XIV.b of this Decommissioning Plan for additional information.

☒ A description of the laboratory instruments and methods that were used for measuring concentrations and the sensitivities of those instruments and methods

Because no sampling of media is planned to support final status surveys, no information is provided in support of the requested information.

☒ The survey results, including tables or charts of the concentrations of residual radioactivity measured

See Table IV.a-1 of this Decommissioning Plan for the 2015 Baseline Verification Summary.

☒ Maps or drawings of the site, area, or building, showing areas classified as non-impacted or impacted

Table IV.a-2 of this Decommissioning Plan provides a summary of current radiological conditions in areas of the Lead Cascade footprint. Table IV.a-3 of this Decommissioning Plan designates the impacted and non-impacted areas within the scope of this Decommissioning Plan. Non-impacted areas are areas where no radiological work was performed, these include Areas C and C1 and the shipping area within the X-7725 building, and the balance of X-3002 building. Impacted areas are shown in Section XIV.d of this Decommissioning Plan.

☒ Justification for considering areas to be non-impacted

Justification for considering areas to be impacted is provided in Table IV.a-3 of this Decommissioning Plan.

☒ A discussion of why the licensee considers the characterization survey to be adequate to demonstrate that it is unlikely that significant quantities of residual radioactivity have gone undetected

The 2015 scoping survey showed that typical contamination level in the Material Balance Area were less than Table 4.6-1 of the License Application levels (cited in Section V.b of this Decommissioning Plan) except for the two areas where contamination was known to exist due to maintenance activities. Routine surveys and job coverage surveys performed

during equipment removal and packaging activities confirmed that contamination levels remained within Lead Cascade license requirements.

☒ For areas and surfaces that are inaccessible or not readily accessible, a discussion of how they were surveyed or why they did not need to be surveyed

Inaccessible systems (floor drains) that will remain in place will be sampled for removable contamination. Return air ducts located in the process building will not be surveyed; however, the Air Handling units in Train 3 will be surveyed.

☒ For sites, areas, or buildings with multiple radionuclides, a discussion justifying the ratios of radionuclides that will be assumed in the final status survey or an indication that no fixed ratio exists and each radionuclide will be measured separately

The single radionuclide of concern is Uranium, in the form of Class D compounds and a naturally occurring assay. Figure II.a-1 located within Appendix C of this Decommissioning Plan provides details of the Lead Cascade areas impacted by potential contamination.

XIV.c. IN-PROCESS SURVEYS

☒ A description of field screening methods and instrumentation

The primary concern during decommissioning activities is controlling removable activity that meets the area posting requirements stated in Table 4.6-1 of the License Application. Areas will be cleared and down posted prior to the final status survey.

☒ A demonstration that field screening should be capable of detecting residual radioactivity at the DCGL

The primary instruments used during in-process surveys were the Ludlum 12 equipped with an alpha scintillator or a GM probe.

Other items and equipment that will remain after decommissioning (walls, uprights, Centrifuge Machine mounts, installed equipment, etc.) and items slated for free release will be surveyed using a Ludlum 12 meter equipped with a Model 43-5 Alpha Scintillation Probe for alpha contamination monitoring or a Model 44-9 GM Pancake Probe for beta-gamma contamination monitoring. This combination exhibits normal alpha background between 5 to 25 cpm, and between 30 and 100 cpm for beta-gamma radiation.

15 percent is used as the beta efficiency of the Model 44-9 Probe, and a Calibration Factor (CF) of 7 (1/0.15) is applied when counting swipe samples. Correcting the CF for the sensitive area of 15.5 cm^2, the scanning or surface contamination CF is conservatively stated as 50 (1/(0.15 x 0.155)).

The Ludlum Model 43-5 Alpha Hand Probe has an efficiency of 50 percent for a correction or CF of 2 (1/0.5) for removable contamination surveys or swipe sample. For surface contamination or total contamination, since the probe sensitive area is 50 percent of 100 cm^2, a CF of 4 (1/(0.5 x 0.5)) is used.

A count rate of 100 cpm above background is easily observed in the field, and at the Lead Cascade, the MDCR is assumed to be 100 cpm. Since 100 cpm meets or exceeds the Lead Cascade free release criteria for surveys, the minimum documented results using the Ludlum 12 are:

- 200 dpm/100 cm^2 alpha and 700 dpm/100 cm^2 beta for removable (or wipe) samples, and
- 400 dpm/100 cm^2 alpha and 5,000 dpm/100 cm^2 beta for direct measurements.

At higher count rates, rapid meter deflections make it difficult for the user to reliably determine levels at or slightly greater than 100 cpm above background. MDA calculations indicate that a background of 300 cpm is the upper limit for quantification that would meet License Application free release criteria when using the instrument.

The limits for surveys performed using the Ludlum 12 are the values listed in Table 4.6-1 of the License Application (cited in Section V.b of this Decommissioning Plan) or 1,000 dpm/100 cm^2 removable or 5,000 dpm/100 cm^2 total.

Ludlum Floor Monitor

A Ludlum 239-1 Floor Monitor may be used to scan a survey units floor area to determine areas of elevated radioactivity. The instrument is equipped with a Ludlum 2224 scaler/ratemeter connected to a 430 cm^2 (effective area) gas proportional detector utilizing P-10 counting gas. The detector height is set to 0.5 inch (1.27 cm). A 0.5-inch detector height was selected to minimize risk of detector damage, while providing reasonable assurance of detecting contamination at the Table 4.6-1 of the License Application limits (cited in Section V.b of this Decommissioning Plan). Typical background levels are between 1,000 and 1,400 cpm (alpha + beta).

Testing indicates that efficiencies with a 0.5-inch detector height are:

Uranium beta	0.148
Technetium-99	0.125
Uranium alpha	0.043
Natural Uranium ($\alpha + \beta$)	0.031

The goal is to balance scan speed with probability of detection. This can be accomplished by selecting a false positive to true positive ratio that allows the operator to make the correct decision with a high level of confidence. In addition, it is imperative that the action level is selected to minimize the necessity to perform detailed surveys of suspect areas. To

ensure detection when using the Floor Monitor we will select an Action Level based on the calculations from NUREG-1507, *Minimum Detectable Concentrations With Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*.
The Scan Minimum Detectable Activity (SMDA) in dpm/100 cm^2 is determined as follows:

$$SMDA = \frac{MDCR}{\sqrt{p} \times e_i \times e_s \times 4.3}$$

where:

p = Surveyor proficiency; is critical when using small detector such as a Ludlum Model 44-9 Pancake Probe; for this evaluation p is set to = 1 since we will have a constant source to distance. The only variable is the scan speed.

e_i = Instrument efficiency for the radionuclide of interest in cpm/dpm

e_s = Source efficiency for the radionuclide of interest. International Organization for Standardization (ISO-7503-1) recommends using 0.25 for alpha and Th betas and 0.5 for ^{243}Pa betas to account for self-absorption losses

4.30 = Probe Active Area/100 cm^2

The MDCR is calculated as follows:

$$MDCR = d' * \sigma_b * \frac{60}{t}$$

where:

d' = index of sensitivity represents the distance between the means of the background and background plus signal (NUREG 1507 Table 6.1)

σ_b = Square root of the expected average background count rate during the observation period (the total time the source is in the detector view).

t = Length of time source is in detector view at a given scan speed in inches/second

Based on detector dimensions a scan speed of 2 inches/second implies the contamination will be in the view of the detector for approximately 3 seconds and easily determined by observing the meter deflection. Testing of the Floor Monitor in the HP counting lab indicated an average count rate of 1,413 cpm of beta and 35 cpm of alpha activity.

Table XIV.c-1 below provides the count Floor Monitor Detection Limits using Reference Point data:

Table XIV.c-1 Floor Monitoring Detection Limits – Reference Points

Natural Uranium Beta (Sr/Y-90)								
	Scan Speed		1 inches/sec		2 inches/sec		3 inches/sec	
BKG	False Pos.	True Pos.	MDCR	SMDA	MDCR	SMDA	MDCR	SMDA
1192	5	95	400	1257	566	1774	693	2173
1192	10	95	356	1119	504	1579	617	1934
1192	20	95	302	950	428	1341	524	1643
1192	30	95	263	828	372	1168	456	1431
1192	40	95	232	728	328	1028	401	1258
MDCR in cpm								
SMDA in dpm per 100 cm^2								
Natural Uranium Alpha								
	Scan Speed		1 inches/sec		2 inches/sec		3 inches/sec	
BKG	False Pos.	True Pos.	MDCR	SMDA	MDCR	SMDA	MDCR	SMDA
22	5	95	54	1182	77	1672	94	2048
22	10	95	48	1053	68	1489	84	1823
22	20	95	41	894	58	1264	71	1548
22	30	95	36	779	51	1101	62	1349
22	40	95	31	685	44	969	54	1186
MDCR in cpm								
SMDA in dpm per 100 cm^2								

An action level (or $MDCR_{AL}$) is established where follow up surveys will be required to ensure the $DCGL_W$ (or basis level) is not exceeded with 95 percent confidence. $MDCR_{AL}$ assuming natural uranium alpha with a 0.5-inch detector height is determined as follows:

$$MDCR_{AL}(cpm) = 5{,}000\ \frac{dpm}{100\ cm^2} \times 0.043 \times 0.25 \times 4.3 = 229\ cpm\ (alpha)$$

The $MCDR_{AL}$ for uranium beta is 1,591 cpm. Therefore, assuming 5,000 dpm/100 cm^2 of natural uranium alpha contamination with uranium daughters (beta emitters) in equilibrium the expected $MDCR_{AL}$ ($\alpha + \beta$) will be 1,820 cpm above background or roughly 3,000 gross cpm.

Since there are fewer beta expected for higher assay of uranium; when using the Floor Monitor during the Lead Cascade Final Status Survey, if the observed gross count rate ($\alpha+\beta$) is greater than or equal to 2,000 cpm, the area is marked. A 1 m^2 area is surveyed with the Ludlum 2224 to quantify contamination levels.

When using the Floor Monitor, Class I survey units will have a 100 percent scan and Class II Survey units will require a 50 percent scan performed. In addition, the Floor Monitor will be used to scan large items (i.e., temporary floor plating) for free release using the gross count expected to meet 5,000 dpm/100 cm^2.

The detector height may be lowered to 0.25 inches for evaluations in selected areas (areas where higher assay uranium is expected) when better efficiency is required. This will increase alpha $MDCR_{AL}$ by roughly 49 percent.

XIV.d. FINAL STATUS SURVEY DESIGN

☒ A brief overview describing the final status survey design
☒ A description and map or drawing of impacted areas of the site, area, or building classified by residual radioactivity levels (Class 1, 2, or 3) and divided into survey units with an explanation of the basis for division into survey units

The final status survey is designed following the guidance in MARSSIM. The areas within the scope of this decommissioning plan have been evaluated and identified as impacted and non-impacted. Table IV.a-3 of this Decommissioning Plan designates the impacted and non-impacted areas within the scope of this Decommissioning Plan. No further investigation will be performed for areas identified as non-impacted as no Lead Cascade radiological activities were performed in these areas. Areas identified as impacted have been segregated into Class 1, Class 2, and Class 3 areas. Each area is further divided into survey units. The required number of data points and grid spacing is determined for each survey unit as applicable. Survey starting points and specific survey locations are plotted and performed as appropriate for the survey unit class. Survey units were initially created based on the area classification. Large areas were further divided to comply with size limitation recommended in MARSSIM. See Table XIV.d-1 within Appendix D of this Decommissioning Plan for the description of the survey units, including area classification.

Lead Cascade equipment has been removed the floor spaces where the equipment was operated or dismantled. The X-3001 building Train 3, X-3001 building North Utility Bay, and the X-7726 facility has the highest potential for residual contamination. Based on survey data collected during equipment removal, it is expected that floor residual contamination will be less that the limits stated in the Table 4.6-1 of the License Application (cited in Section V.b of this Decommissioning Plan) (5,000 dpm/cm^2). Routine Surveys conducted during equipment removal and packaging activities did not detect any elevated radiation levels nor were there any documented personnel contamination events. Prior to the final status survey expansion joints, stress cracks, and penetrations into floors and walls for piping, conduit, and anchor bolts, etc. will be surveyed. Remediation may be required if levels exceed Table 4.6-1 of the License Application (cited in Section V.b of this Decommissioning Plan).

The Utility Bays have multiple raised equipment mounts. In addition to the systematic survey locations, equipment mounts used during Lead Cascade operations will be 100

percent surveyed and decontaminated if levels exceed Table 4.6-1 of the License Application levels (cited in Section V.b of this Decommissioning Plan).

The Class I Survey Units are areas that had or have known contamination levels exceeding Table 4.6-1 of the License Application levels (cited in Section V.b of this Decommissioning Plan) and areas that required decontamination because of Lead Cascade activities. These areas will have a 100 percent survey performed using a floor monitor. In addition, contamination levels will be quantified using the Ludlum 2224. The two small areas located in the X-3001 building North Utility Bay are classified as Class I Survey Units.

Except for two small areas noted above that have since been decontaminated, scoping survey indicates all other impacted areas within the Lead Cascade are Class II or Class III Survey Units. During equipment removal and packaging, HP personnel performed job coverage surveys (and scoping surveys) to identify areas that may require decontamination. None were identified.

Depending on probability of contamination, Class II Surveys Units will be either a 50 percent scan using the floor monitor, or a systematic grid survey using the Ludlum 2224. Large areas (e.g., Train 3) will be divided into equal size areas such that the Survey Unit does not exceed 1,000 m^2. The typical size of a Survey Unit is 676 m^2.

Each systematic survey unit will be gridded and 15 randomly generated survey locations will be selected based on a triangular grid. At each survey location, a 1 m^2 area will be scanned and a static survey will be performed at the location of the highest observed scanning count rate. Systematic surveys may be augmented with a floor monitor.

The transfer corridors in the X-3012 and X-3001 buildings along with X-7727H corridor were used to transport centrifuge machines to and from the X-7726 facility. Review of routine survey data reveals that contamination on the exterior of centrifuge machines has been significantly less than Lead Cascade License Application contamination limits; therefore, these areas are designated as Class III areas.

Office areas in the X-7725 and X-3012 buildings are designated Class III areas based on absence of radiological work in these areas and routine survey data review. However, survey locations in these areas will be based on personnel traffic patterns rather than random survey points. Based on review of routine survey and the reduced contamination potential, a 90/95 percent Statistical Survey will be performed in these Class III areas.

Data indicates the X-7726 facility should be Class II survey. However; this is a complex facility with multiple levels and work was performed in different locations within the facility. Accordingly, there will be a minimum of ten systematic surveys in this facility with 15 sample location each. In addition, a 50 percent scanning survey will be performed on the ground floor. Surveys of the walls and support beams will be performed.

Figure II.a-1 within Appendix C of this Decommissioning Plan depicts the Lead Cascade footprint. While all of the floor surfaces in the Lead Cascade buildings/facilities depicted on Figure II.a-1 are considered potentially impacted, some surfaces other than the floors have been determined to not be impacted and those areas are listed in Table IV.a-3 of this Decommissioning Plan. Additionally, Table XIV.d-1 within Appendix D of this Decommissioning Plan shows the proposed survey units scheduled to be performed during the Final Status Survey.

Table XIV.d-2 below provides the pCi/l for the LEC system over the past twelve years. The LEC tanks were installed to collect accumulated liquids from the GCEP buildings. There are 13 tanks associated with Lead Cascade operations. The LEC tanks are checked monthly.

Four of the tanks collect waters associated with Generators and or fuel tanks and will consist of a mixture of oil and water. The remaining LEC tanks will collect liquids from the X-3001 building, X-7726 facility, and X-7727H corridor.

The tanks are four feet in diameter with a capacity of approximately 550 gallons; therefore, the liquid effluents may only require pumping annually. When the measured level reaches 30 inches of liquid, in accordance with currently approved procedure, the water is sampled prior to being transferred to the X-6619 STP. The X-6619 STP facility manager grants authorization prior to commencement of transferred after their review of the data.

If the sample results are unacceptable (i.e., does not meet X-6619 STP NPDES Permit requirements), the contents are collected and disposed of appropriately. The most likely reason for rejection would be turbidity (suspended solids).

The tank design is such that approximately 2 inches of effluent will remain in the bottom of the tanks. Over time there will be a concentration of solids or "sludge" collected in the bottom of the tank. The "sludge" sample, if reported as effluent, will provide a distorted view of actual effluents discharge to the X-6619 STP.

Review of the effluent sample data indicates elevated uranium concentrations in 2012, 2015, and 2016. These were "sludge" sample results rather than waste water effluent normally transferred to the X-6619 STP. Specifically:

1. The 2012 sample was of "sludge" from one of the X-3001 building "Oily Water" tanks. Based on HP surveys, it is highly unlikely that the elevated uranium results were due to Lead Cascade UF_6 operations, but rather from natural uranium in water as well as diesel fuel and lubricants. Removable contamination samples collected from X-3001 building Utility Bay floor drains do not indicate elevated levels of radioactivity.

2. The 2015 sample result was from a LEC tank collecting effluent from the South end of the X-3002 building. There were no radiological activities associated with Lead Cascade operations in the X-3002 building.

3. The 2016 "sludge" sample was from a tank that collected liquids from the Northeast comer of the X-3012 building and Northwest corner of the X-3002 building. There were no radiological operations performed in this area during the life of the Lead Cascade. The "sludge" from this tank has been collected and is waiting disposal as hazardous waste.

Further review of samples collected before and after the 2012 and 2015 data results are in the expected range typically less than 0.2 percent of the maximum levels indicated in the Decommissioning Plan Table. The "sludge" associated with the 2016 sample has been collected and is waiting disposal.

Review of HP data, specifically air sample and removable contamination surveys, does not indicate any releases or contamination events in areas associated with the results reported in the Decommissioning Plan. In addition, centrifuge machines were surveyed when removed from the cascade and there have been no instances of removable contamination.

Results from the X-3001 building liquid effluent results ranged from 0.6 to 2.83 μg of uranium/liter. Data from the 2015 Portsmouth Environmental Report indicated natural uranium concentrations of 2.65 μg/l in offsite residential well water.

Sludge samples were removed from the data presented within Table XIV.d-2 below, since the sludge data are not indicative of liquid effluents transferred to the X-6619 STP for normal processing.

Table XIV.d-2 LEC Tanks Liquid Effluent
Years 2006 – 2017

Year	2006	2007	2008	2009	2010	2011	2012*	2013	2014	2015**	2016 *	2017[3]
Uranium pCi/l												
Number of Samples [1]	0	0	18	7	9	13	28	10	17	29	26	35
Number of Samples < [2]	0	0	18	3	9	13	25	10	17	22	19	31
Average	0.00E+00	0.00E+00	< 2.56E+00	< 1.21E+00	< 2.98E+00	< 2.41E+00	< 4.81E+01	< 5.45E+01	< 7.99E+00	< 1.73E+02	< 1.64E+02	<71.11E+01
Standard Deviation	0.00E+00	0.00E+00	< 2.27E+00	1.29E+00	< 2.23E+00	< 2.34E+00	1.04E+02	< 5.20E+01	< 9.24E+00	5.01E+02	3.62E+02	2.49E+02
Maximum	0.00E+00	0.00E+00	< 6.76E+00	3.93E+00	< 6.20E+00	< 6.70E+00	4.94E+02	< 1.38E+02	< 3.32E+01	2.3E+03	1.36E+03	1.37E+03

Notes:
* Two sludge samples removed from analysis.
** One sample from X-3002 building removed from analysis.
1. The "number of samples" shows the total number of samples collected, including replicate samples collected.
2. The "number of samples <" shows the number of samples that were lower than the Minimum Detectable Concentration.
3. 2017 LEC tank results do not represent the entire year (includes sample results through November 2017).

X-3001 building North Utility Bay contains the following floor drains:

1. Each Utility Bay has two 12" sloped drains.
2. The RHW pump area has three raised drain approximately 3" above the floor.
3. Each generator room has one 12" sloped drain and three raised condensate drains.
4. The Trains 1/2 and 3/4 MCW pump area has one 12" sloped drain and 14 raised drains.
5. There is also one raised drain at the chemical addition area near the elevator.
6. Centrifuge machine mount drain to a LEC.

Floor drains located in X-3001 building North Utility Bays and X-7726 facility will be surveyed. Floor drains will be decontaminated if contamination exceeds Table 4.6-1 of the License Application levels (cited in Section V.b of this Decommissioning Plan). Since the LEC system is an integral part of the leased facility structure and will ultimately be returned to the DOE, there are no plans to remove the LEC system during this Decommissioning effort.

Train 3 Centrifuge Machine Floor Mount Surveys

There are 720 Floor Mounts in Train 3, during Lead Cascade operations approximately 290 had centrifuge machines installed. Cascade 1 contained 120 operating machines. Centrifuge Machines were operated in the North portions of Cascades 2, 3, and 5 for much shorter periods. Non- operating machines were stored in the North half of Cascades 3, 4, and 5 prior to ceasing operations.

When a machine was transferred from Train 3 it was surveyed and no evidence of removable contamination were discovered. Accordingly, the final survey will include:

1. 60 floor mount drains in Train 3 which contained operating Centrifuge Machines will be sampled. In addition, floor mount drains will be sampled in Trains 4 and 6.
2. The samples will consist of a smear of the inlet to the drain header.
3. The selected floor mounts will be surveyed with Ludlum 12 (alpha and beta) for total contamination
4. 15 samples of the Trains 3 and 4 drain header will also be collected.

Since airborne radioactivity sampling were consistently below 0.1 percent of the DAC wall contamination is highly unlikely. X-3001 building North walls in Trains 2 and 3 Utility Bay and Mezzanine will be surveyed up to 8 feet above floor level. A minimum of 60 randomly selected survey locations will be selected, consisting of a 1 m^2 scan and a single stationary data point. The need for decontamination will be determined if results exceed Table 4.6-1 of the License Application levels (cited in Section V.b of this Decommissioning Plan).

Lead Cascade process piping and equipment situated in Train 3 Utility Bay has been removed. While job coverage surveys of did not reveal elevated contamination levels, to be conservative the overhead areas of Utility Bay will be surveyed for removable contamination. In addition, direct contamination levels will be evaluated to ensure

contamination levels do not Table 4.6-1 of the License Application levels (cited in Section V.b of this Decommissioning Plan).

Process Building Ventilation System

The Lead Cascade heating and ventilation systems are designed to maintain the environment required for proper operation of the process and associated equipment in the process buildings. The main subsystems affecting X-3001 building are the Process Area Ventilation System and the Process Area Heating and Pressurization System.

The Process Area Ventilation System provides circulation of air and maintains a positive pressure with respect to the outside ambient atmospheric pressure in X-3001 building to reduce the infiltration of dirty and/or cold air. Each ventilation unit consists of a supply fan, a return/exhaust fan, filters, and associated ductwork with automatic dampers, and controls. The return/exhaust air fan draws heated air from the centrifuge machine area and, depending on the building temperature, exhausts it to the outside or recirculates it to the supply fan plenum. If it is necessary to cool the process building, outside air is drawn through a damper into the supply fan plenum where it mixes with air from the return/exhaust fan and passes through a filter to the supply fan inlet. The supply fan discharges through a damper into a large duct located along the length of the cascade on top of the service module piping.

Ductwork associated with the Lead Cascade equipment has been removed and only ductwork from the original GCEP remain. There are no plans to remove original GCEP installed ventilation equipment.

The ventilation filters have been routinely changed during the life of the Lead Cascade. The filters were surveyed prior to disposal; review of this data indicates contamination level were less than Table 4.6-1 of the License Application (cited in Section V.b of this Decommissioning Plan). In addition, no contamination levels above this limit were detected by surveys performed during ventilation system maintenance activities.

For worker safety due to the elevation of the return air duct work and the lack of evidence of airborne radioactivity during the life of the Lead Cascade, the return air duct work will not be surveyed. The ventilation supply components in the X-3001 building and X-7726 facility will be surveyed to ensure contamination levels are consistent with Table 4.6-1 of the License Application limits (cited in Section V.b of this Decommissioning Plan).

The Train 3 return air ventilation units located on the Train 3 Mezzanine will be surveyed (6 from the Cascade Area and 2 for the Utility Bay) to verify no buildup of radioactive material. 50 percent of the ventilation units in Trains 2 and 4 and the return air ventilation units in the X-7726 facility will be surveyed. These surveys will evaluate both direct and removable contamination.

Figure II.a-1 within Appendix C of this Decommissioning Plan depicts the Lead Cascade footprint. While all of the floor surfaces in the Lead Cascade buildings/facilities depicted

on Figure II.a-1 are considered potentially impacted, some surfaces other than the floors have been determined to not be impacted and those areas are listed in Table IV.a-3 of this Decommissioning Plan. Additionally, Table XIV.d-1 within Appendix D of this Decommissioning Plan shows the proposed survey units scheduled to be performed during the Final Status Survey.

$N_{(0.05)}$, the minimum number of sample locations to ensure any elevated areas of contamination would be identified, and sufficient data for statistical analysis, is shown in Table XIV.a-1 of this Decommissioning Plan. This table is based on the X-3001 building Utility Bay Scoping Survey data performed in 2015, assuming a 95 percent confidence level, and using MARSSIM criteria (formula 5-1).

From Table XIV.a-1 of this Decommissioning Plan, it can be seen that the Relative Shift is calculated to be 7.15. MARSSIM recommends setting the LBGR to yield a Relative Shift (Δ/σ) between 1 and 3. Table XIV.a-3 of this Decommissioning Plan depicts the adjusted LBGR.

MARSSIM Table 5.3 "Values of N/2 for Use with the Wilcoxon Rank Sum Test" indicates a survey unit with a Relative shift of between 2.0 and 2.25 should consist of between 14 and 15 sample locations for 95 percent confidence. The number of sample locations will be increased to 15 for a Survey Unit of approximately 676 m^2 (1/4 of the Train 3 floor area).

For systematic surveys using a Ludlum 2224, 15 data points will be preselected using a triangular grid. Additional locations will be selected based on inspection of the area (discolored areas, cracks, etc.).

For determining sample locations L is calculated:

$$L = \sqrt{\frac{Area}{0.866 * n}}$$

$$Next\ Row = 0.866 * L$$

Systematic Floor Survey Units in the X-3001 building:

1. Area is gridded 21 m by 32 m
2. The random start locations (X and Y) between 1 and 5 are determined.
3. Distance from Random Start L calculated
4. Next Row is calculated.

An example of the sample locations for a Train 3 Survey Unit (Train 3 will consist of four separate Survey Units). Survey Units for other areas will vary based on the area dimensions.

Using the *Excel* spreadsheet function (RANDBETWEEN), a random start location is determined within a 5-meter square area in the Northwest corner of each survey unit (shown in the following). As noted above, additional readings may be taken at the HP Technicians or management's discretion.

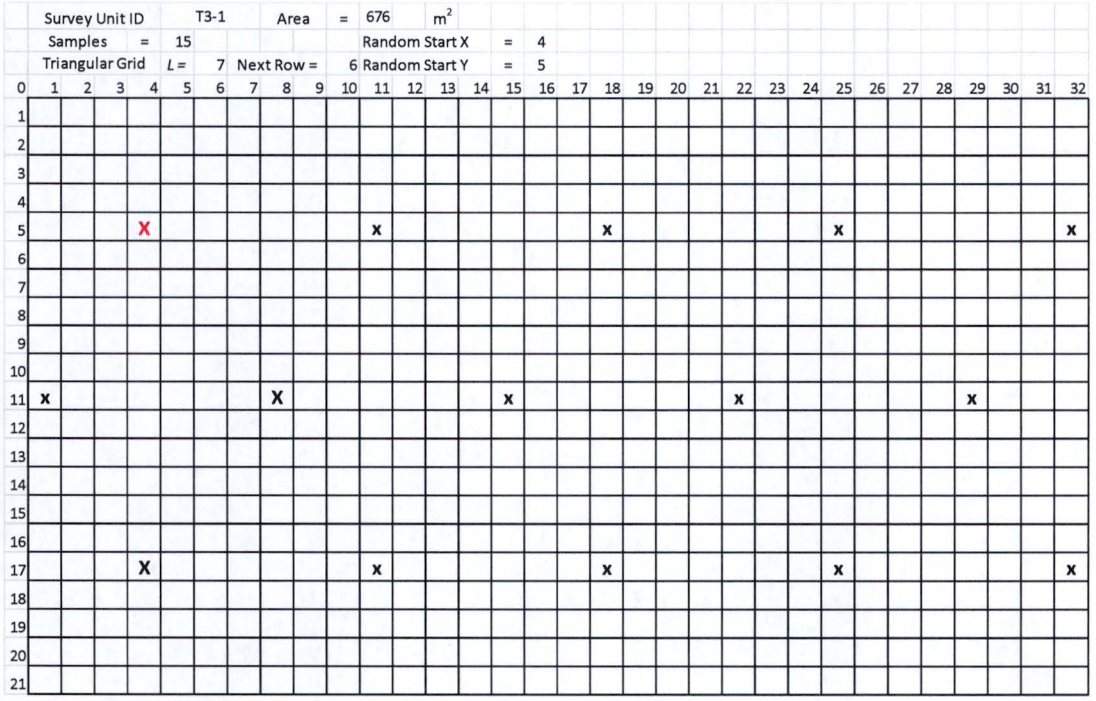


Figure XIV.d-1 Systematic Survey Locations

1. If a sample location exceeds the DCGLw (50,000 dpm/100 cm^2) a $DCGL_{EMC}$ evaluation is required in a 9 m^2 area surrounding the elevated sample location.
2. If a sample location exceeds Table 4.6-1 of the License Application (cited in Section V.b of this Decommissioning Plan) (5,000 dpm/100 cm^2) additional readings will be collected in a 9 m^2 area surrounding the elevated area to determine extent of contamination. The area will be deconned and the Survey Unit resurveyed.
3. For Class II Survey Units, if all survey locations indicate less than 1,000 dpm/100 cm^2, no further actions are required; however, additional surveys locations may be requested by the RPM.

Table XIV.d-1 within Appendix D of this Decommissioning Plan shows the proposed survey units scheduled to be performed during the Final Status Survey. The surveys were selected based on known contamination conditions and contamination potential during equipment removal activities. Additionally, Figure II.a-1 within Appendix C of this Decommissioning Plan depicts the areas of Lead Cascade buildings/facilities potentially impacted with residual radioactivity. As noted within Table XIV.d-1, the two small Class I areas are less than 9 m^2.

☒ A description of the background reference areas and materials, if they will be used, and a justification for their selection

Because uranium may exist in trace quantities of structural materials (primarily concrete), background reference data will be used for the final status surveys. The description and justification for this data is included in Section IV.a of this Decommissioning Plan.

☒ A summary of the statistical tests that will be used to evaluate the survey results

The null hypothesis for each survey unit is that the residual radioactivity concentrations exceed the release criterion. Acceptable decision error probabilities for testing the hypothesis were determined to be α=0.05 and β=0.05 for all concrete survey units.

To verify the null hypothesis, a WRS test will be performed for each Systematic Survey Unit to determine if contamination may exceed Table 4.6-1 of the License Application levels (cited in Section V.b of this Decommissioning Plan). Since uranium is the contaminant of concern at the Lead Cascade, the alpha count rates for the survey points are evaluated using a minimum of five daily reference point readings, additional reference point readings may be included from existing data when applicable.

Statistical tests will be used to evaluate survey results. Criteria evaluated during the WRS test include:

1. Sample average is less than 5,000 dpm/100 cm^2;
2. Sample standard deviation is less than 3 times the Reference Point(s) standard deviation;
3. Difference of the Sample mean and sample median are less than 1;
4. Sample survey points are less than 2 times the MDA; and
5. Sample standard deviation is less than 1.645 times the reference point standard deviation.

If the Survey Unit fails these criterion, additional surveys may be required to ensure the Survey Unit is acceptable.

An example of the WRS Evaluation Sheet based on recent scoping data is shown below in Table XIV.d-3.

Table XIV.d-3 Example –WRS Evaluation Sheet

	Reason for Survey	UB3-2			
	Location of Survey	Train 3 Utility Bay			
	Alpha Contamination WRS Evaluation Sheet				
	Data points < Table 4.6-1	**Pass**	**Continue**		
	Data points < 20% Table 4.6-1	**Pass**	**No further evaluation needed, No postings required**		
	Evaluation Criteria:		WRS Hypothesis	H_0	The median concentration in the survey unit exceeds that in the reference area by more than the $DCGL_w$
				H_a	The median concentration in the survey unit exceeds that in the reference area by less than the $DCGL_w$
	Section 1a - Statistical Evaluation				
	Sample Avg <$DCGL_w$	Yes	Meets 25 mrem criteria		
	S StdDev < 3 x R StdDev	Yes	Meets normal distribution		
	Delta S Mean/Median ≤ 1.0	0.27	Results within bounds		
	MDA Evaluation (# > MDA)	0	Survey points < 2 x MDA		
	Section 1a conclusion	Pass	No further Evaluation Required		
	Section 1b - Statistical Evaluation				
	# S StdDev reasonable	NA	NA		
	Part 1b Evaluation conclusion	NA	NA		
	Section 2 - Elevated Measurement Evaluation				
a	Delta S Max & R Min <$DCGL_w$	Yes	Survey unit meets release criterion		
b	Delta S Avg & R Avg <$DCGL_w$	Yes	Survey unit meets release criterion		
c	Delta Any S & Any R >$DCGL_w$ **and** Delta S Avg & R Avg < DCGLw	No	No further evaluation of Survey Unit required		
	WRS Validated Hypothesis	Ha	The median concentration in the survey unit exceeds that in the reference area by less than the DCGLw		
	Comments				
	Surevy perform to verify contamination levels acceptable for delease. Data indicates the facility meets 10 CFR 20.1402 25 mrem criteria.				
	Reviewed by:				
	Date	12/14/2017			

☒ A description of scanning instruments, methods, calibration, operational checks, coverage, and sensitivity for each media and radionuclide

The scanning floor monitor is discussed in Section IV.b of this Decommissioning Plan and the hand-held monitor is discussed in Section X.g of this Decommissioning Plan.

☒ For in-situ sample measurements made by field instruments, a description of the instruments, calibration, operational checks, sensitivity, and sampling methods, with a demonstration that the instruments and methods have adequate sensitivity

☒ A description of the analytical instruments for measuring samples in the laboratory, as well as calibration, sensitivity, and methods with a demonstration that the instruments and methods have adequate sensitivity

☒ A description of how the samples to be analyzed in the laboratory will be collected, controlled, and handled

No in-situ or laboratory measurements are necessary for surface and subsurface soil for reasons discussed in section V.a.2 of this Decommissioning Plan.

☒ A description of the final status survey investigation levels and how they were determined

The Licensee will evaluate data if a sample location contamination exceeds 20 percent of the License limit (approximately 40 cpm of alpha activity). This Action Level is selected to be equivalent to the removable contamination limit stated in Table 4.6-1 of the License Application (cited in Section V.b of this Decommissioning Plan).

☒ A summary of any significant additional residual radioactivity that was not accounted for during site characterization

This information will not be available until the Final Status Survey is complete and will be included in the Final Status Survey Report.

☒ A summary of direct measurement results and/or soil concentration levels in units that are comparable to the DCGL, and if data is used to estimate or update the survey unit

No direct measurement results and/or soil concentration levels comparable to the DCGL are necessary for surface and subsurface soil for reasons discussed in section V.a.2 of this Decommissioning Plan.

☒ A summary of the direct measurements or sample data used to both evaluate the success of remediation and to estimate the survey unit variance

All Remediation has been completed and the Licensee does not expect the Final Status Survey to identify any areas that exceed Lead Cascade License limits.

XIV.e. FINAL STATUS SURVEY REPORT

☒ An overview of the results of the final status survey
☒ A discussion of any changes that were made in the final status survey from what was proposed in the DP or other prior submittals
☒ A description of the method by which the number of samples was determined for each survey unit
☒ A summary of the values used to determine the number of samples and a justification for these values
☒ The survey results for each survey unit include:
- — The number of samples taken for the survey unit;
- — A description of the survey unit, including (a) a map or drawing of the survey unit showing the reference system and random start systematic sample locations for Class 1 and 2 survey units and random locations shown for Class 3 survey units and reference areas, and (b) a discussion of remedial actions and unique features;
- — The measured sample concentrations in units that are comparable to the DCGL;
- — The statistical evaluation of the measured concentrations;
- — Judgmental and miscellaneous sample data sets reported separately from those samples collected for performing the statistical evaluation;
- — A discussion of anomalous data, including any areas of elevated direct radiation detected during scanning that exceeded the investigation level or measurement locations in excess of $DCGL_W$; and
- — A statement that a given survey unit satisfied the $DCGL_W$ and the elevated measurement comparison if any sample points exceeded the $DCGL_W$.

☒ A description of any changes in initial survey unit assumptions relative to the extent of residual radioactivity (e.g., material not accounted for during site characterization)
☒ A description of how ALARA practices were employed to achieve final activity levels
☒ If a survey unit fails, a description of the investigation conducted to ascertain the reason for the failure and a discussion of the impact that the failure has on the conclusion that the facility is ready for final radiological surveys and that it satisfies the release criteria
☒ If a survey unit fails, a discussion of the impact that the reason for the failure has on other survey unit information

Following the completion of the Final Status Survey, the Licensee commits to providing a Final Radiation Survey Report (FSRS) to the NRC for review and approval to allow final termination of the NRC Materials License (SNM-7003). The FSRS will contain the following information:

- An overview of the results of the final status survey
- A discussion of any changes made in the final status survey from what was proposed in the Decommissioning Plan or other prior submittals

- A description of the method by which the number of samples was determined for each survey unit
- A summary of the values used to determine the number of samples and a justification for these values
- The survey results for each survey unit will include:
  - — The number of samples taken for the survey unit;
  - — A description of the survey unit, including (a) a map or drawing of the survey unit showing the reference system and random start systematic sample locations for Class 1 and 2 survey units and random locations shown for Class 3 survey units and reference areas, and (b) a discussion of remedial actions and unique features;
  - — The measured sample concentrations in units dpm/100 cm^2;
  - — The statistical evaluation of the measured concentrations;
  - — Judgmental and miscellaneous sample data sets reported separately from those samples collected for performing the statistical evaluation;
  - — A discussion of anomalous data, including any areas of elevated direct radiation detected during scanning which exceeded the investigation level or measurement locations in excess of $DCGL_W$; and
  - — A statement that a given survey unit satisfied the $DCGL_W$ and the elevated measurement comparison if any sample points exceeded the $DCGL_W$.
- A description of how ALARA practices were employed to achieve final activity levels
- If a survey unit fails, a description of the investigation conducted to ascertain the reason for the failure and a discussion of the impact the failure has on the conclusion the facility is ready for final radiological surveys and satisfies the release criteria
- If a survey unit fails, a discussion of the reason for the failure and the impact the failure has on other survey unit information
- A RESRAD-BUILD evaluation will be performed for primary process and support areas (i.e., X-3001 building and X-7726 facility).
- If removable contamination ratios exceed 10 percent of License Application Table 4.6-1 limits and/or intended use of the area were to change; the Licensee will re-evaluate the DCGL.

XV. FINANCIAL ASSURANCE

XV.a. COST ESTIMATE

☒ A cost estimate that appears to be based on documented and reasonable assumptions

As committed within Section 3.0 of the Decommissioning Funding Plan (DFP) (NR-2605-0004) the Licensee's estimated costs of decommissioning the Lead Cascade are currently patterned after the NRC guidance in Appendix A of NUREG-1757, Volume 3, *Consolidated Decommissioning Guidance, Financial Assurance, Recordkeeping, and Timeliness*. The Licensee has revised the currently approved Decommissioning Funding

Plan cost estimate to reflect the current decommissioning activities as described within this Decommissioning Plan, and is provided within Appendix A and B for NRC's review and approval. The tables have been converted to the new numbering system of A and B versus the previously approved C and D, only providing those tables with costs that have yet to be incurred.

On December 21, 2016, (DOE 16-0019) Centrus requested the DOE's approval to transfer thirty-seven Model 12B cylinders, including UF_6 contents, that at the time were located in space leased by ACO, an indirect subsidiary of Centrus. On Mach 20, 2017, in accordance with the GCEP Lease, DOE approved Centrus' request for the early return to DOE of the eighteen DOE-owned UF_6 Model 12B cylinders, including UF_6 contents, leased to ACO as leased personalty as well as the transfer to DOE of the nineteen Centrus-owned UF_6 Model 128 cylinders, including UF_6 contents. On April 5, 2017, all thirty-seven Model 12B cylinders of Lead Cascade UF_6 material transferred to the Portsmouth Gaseous Diffusion Plant DandD contractor (FBP). Transfers were handled in accordance with Section 7.3 of the NRC-approved Fundamental Nuclear Material Control Plan (FNMCP) for the American Centrifuge Lead Cascade Facility (NR-2605-0003), which states in part, transfers of nuclear materials into or out of the Lead Cascade are documented in accordance with requirements of 10 CFR 74.15. This activity was conducted as on-site transfers, DOE accepted title to this material, and no costs were incurred by ACO for this disposition; therefore, costs were excluded from the enclosed Decommissioning Cost Estimate.

The amount of calibration source material which ACO, as the Licensee, is responsible to remove in order to terminate the Lead Cascade Materials License is as follows:

Source ID	Isotope	Original Activity	Units	Date of Record
672	Th-230	2.00E+04	dpm	11/01/1993
930	Tc-99	5.39E+03	dpm	04/22/1993
1428	Th-230	1.92E+04	dpm	05/28/1997
1429	Sr-90	1.69E+04	dpm	05/28/1997
1483	Sr-90	8.00E-03	uCi	01/29/1992
2031	Sr-90	5.63E+02	uCi	03/01/1994

These calibration sources will be transferred to FBP following the completion of the Final Radiation Survey task of the decommissioning efforts for the Lead Cascade. Similar to the transfer of thirty-seven UF_6 Model 12B cylinders discussed above, ACO expects no costs to be incurred for this final disposition and transfer of ownership; therefore, costs were excluded from the enclosed Decommissioning Cost Estimate.

Holdup is licensed material (UF_6) which adhered to the process equipment and piping interior surfaces so it was spread throughout the Lead Cascade. The Lead Cascade classified and/or contaminated waste (i.e., holdup of licensed material [UF_6]) was handled in accordance with Section 7.3 of the NRC-approved FNMCP (NR-2605-0003), which states in part, transfers of nuclear materials out of the Lead Cascade are documented in

accordance with requirements of 10 CFR 74.15. Nuclear Material Transaction Reports (formerly DOE/NRC Form 741) documented transfers to NNSS of 1g or more of special nuclear material.

Since the Lead Cascade decommissioning activities are nearing completion, the overall tasks for Planning and Preparation; Decontamination or Dismantling of Radioactive Facility Components; and Restoration of Contaminated Area on Facility Grounds have been removed from this estimate. The Packaging, Shipping, and Waste Disposal Costs and Equipment/Supply Costs associated with the removal of classified and/or contaminated waste (i.e., holdup of licensed material [UF_6]), have been removed from this estimate since the shipping campaign has been completed. These expenditures have been realized and no longer required to complete the decommissioning efforts at the Lead Cascade.

The costs associated with the Final Radiation Survey task remain and are provided within Appendix A and B of this Decommissioning Plan.

XV.b. CERTIFICATION STATEMENT

☒ The certification statement is based on the licensed possession limits and the applicable quantities specified in 10 CFR 30.35, 40.36, or 70.25

☒ The licensee is eligible to use a certification of financial assurance and, if eligible, that the certification amount is appropriate

As currently approved by the NRC, Appendix A of the DFP provided the model funding instruments to be utilized, which includes the Model Certification of Financial Assurance. This certification included the type and amount of material as listed within the possession limits of NRC Materials License (SNM-7003) and Table 1.2-1 of the License Application for the Lead Cascade.

XV.c. FINANCIAL MECHANISM

☒ The financial assurance mechanism supplied by the licensee consists of one or more of the following instruments: surety bond; letter of credit; etc.

As previously committed within Section 4.0 of the DFP, the Licensee utilized a surety bond to provide reasonable assurance of decommissioning funding, pursuant to 10 CFR 70.25(f)(2).

☒ The financial assurance mechanism is an originally signed duplicate

The total estimate for the remaining decommissioning activities at the Lead Cascade is $3,650,000. This new estimate is minimal in comparison to the amount of $15,980,000 approved by and is currently held by the NRC within the executed surety bond as previously provided on April 15, 2013 by letter ACO 13-0024 (TAC Number L34235). The Licensee expects to complete the Lead Cascade decommissioning activities in early

2018 and will request return of the executed bond at the time of request for termination of the NRC Materials License.

☒ The wording of the financial assurance mechanism is identical to the recommended wording provided in Appendix F of this document

As previously discussed within Section XV.a of this Decommissioning Plan, the Licensee uses the model documentation contained within the DFP, which was patterned after the guidance provided within Volume 3 of NUREG-1757, when preparing and executing funding instruments for the Lead Cascade.

☒ For a licensee regulated under 10 CFR Part 72, a means is identified in the DP for adjusting the financial assurance funding level over any storage and surveillance period

The Lead Cascade is licensed under the provisions of 10 CFR Part 70; therefore, this section does not apply. However, the Licensee's has disposed of all classified and/or radioactive materials as scheduled with no storage credit taken; therefore, there will be no adjustments of the financial assurance funding level over any storage and surveillance period.

☒ The amount of financial assurance coverage provided by the licensee for site control and maintenance is at least as great as that calculated using the formula provided in this NUREG

The NRC Materials License (SNM-7003) for the Lead Cascade is not being terminated under restricted conditions pursuant to 10 CFR 20.1403; therefore, according to NUREG-1757 guidance, financial assurance for site control and maintenance following license termination is not required. As stated in Section XVI below, the Lead Cascade will be prepared for return to the DOE for unrestricted use in accordance with the lease requirements.

XVI. RESTRICTED USE/ALTERNATE CRITERIA

The GCEP Lease between the DOE and the United States Enrichment Corporation for the GCEP Appendix 1, Section 4.3, *Return of GCEP Leased Premises, GCEP Leased Facilities, and GCEP Leased Personalty*, Section (c) states in part, "Prior to returning the GCEP Leased Facilities, the Corporation will comply with the following criteria: 1) For radiological contamination, the GCEP Leased Facilities shall be returned in a condition that meets NRC's radiological criteria for unrestricted use in 10 CFR 20.1402, as amended." Therefore, based upon this lease condition, at the completion of decontamination and decommissioning of the Lead Cascade, the facilities will be prepared for return to the DOE for unrestricted use per lease requirements and this section is not applicable.

Enclosure 2 of ACO 18-0001

NRC's Request for Supplemental Information Cross-Reference

Information Contained Within	
Does Not Contain	
Export Controlled Information	
Reviewing Official:	ECI Reviewer #152
Date:	01/04/2018

American Centrifuge Operating, LLC's (ACO) Cross-Reference to the U.S. Nuclear Regulatory Commission's (NRC) Requests for Supplemental Information

1. Characterization

Given that certain decommissioning activities have been and are underway that are authorized under the current license, for each survey unit, please provide the information identified below to allow the U.S. Nuclear Regulatory Commission (NRC) staff to evaluate the Final Status Survey (FSS) design and the clean-up level(s) being proposed by Centrus Energy Corporation (Centrus).

a. The radiological concentrations/levels (or estimate with basis or rationale) Centrus expects at the start of any remediation (decontamination) activities that will be covered under the (approved) Decommissioning Plan (DP).

ACO Response:

Section IV.a of the Decommissioning Plan contains this response.

b. The radiological concentrations/levels (or estimate with basis or rationale) Centrus expects after all remediation (decontamination) is accomplished to include assumptions with a commitment to revisit the assumptions to ensure that proposed Derived Concentration Guideline Level(s) (DCGL) remain appropriate.

ACO Response:

Section XIV.e of the Decommissioning Plan contains this response.

c. Identification of any potential contamination in unintended areas as a result of ongoing remediation (decontamination or decommissioning) activities.

ACO Response:

Section IV.a of the Decommissioning Plan contains this response.

d. Reference to characterization reports used to describe the site characterization (for each survey unit or group of survey units).

ACO Response:

Section IV.a of the Decommissioning Plan contains this response.

e. A description of the baseline radiological survey to include scope and methodology. Reference to baseline radiological survey data.

ACO Response:

Section IV.a of the Decommissioning Plan contains this response.

f. Radiological status of contaminated structures, systems, and equipment (at the start of decommissioning under the DP) and type of material (i.e., metal, concrete, plastic, etc.) that are to remain (i.e., air ventilation system, drains, underground waste lines, etc.) to include identification of how any residual radioactivity relates to the past operations/incidents and decommissioning activities being conducted under the current license).

ACO Response:

Section IV.a of the Decommissioning Plan contains this response.

2. FSS Plan

Please provide the following information on the FSS strategy to facilitate the NRC staff's understanding of how Centrus intends to meet the regulatory requirements for unrestricted release.

a. Clarify whether Centrus intends to include ceilings and walls or just floors in its FSS design. Also, provide a more detailed justification for Class 2 areas.

ACO Response:

Section XIV.d of the Decommissioning Plan contains this response.

b. Explain the contamination control strategy for areas that are remediated or surveyed to demonstrate compliance while other decommissioning activities that are underway.

ACO Response:

Section X.f of the Decommissioning Plan contains this response.

c. For Class 1 survey units, provide a list of area factors that will be used to determine a $DCGL_{emc}$1 for each radionuclide and media of concern.

ACO Response:

Section XIV.a of the Decommissioning Plan contains this response.

d. Identify Lead Cascade Facility operational (physical) areas where licensed radiological material was present or could be present (to include the decommissioning activities currently authorized) that overlap current or past U.S. Department of Energy (DOE) operational (physical) areas where radiological material is currently being used or was used and is present or was present. Include a summary of the history of the types and levels of radiological contamination (licensed material and any DOE radiological material) and its distribution.

ACO Response:

Section II.c of the Decommissioning Plan contains this response.

e. Summarize, provide, or reference any survey data used in Centrus' dose assessments for the unrestricted release scenario at the time of license termination and for the reasonably foreseeable land use scenario.

ACO Response:

Section V.b of the Decommissioning Plan contains this response.

3. Dose Assessment

For the NRC staff to evaluate Centrus' dose assessment used to derive the DCGLs, please provide the following information.

a. A description of the reasonably foreseeable land use scenario and average member of the critical group, to include assumptions and data use.

ACO Response:

Section V.b of the Decommissioning Plan contains this response.

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1 As defined in NUREG-1757.

b. Justification for the site-specific DCGLs listed in the proposed DP including site-specific parameter values used to derive the DCGLs. Justification for any generic DCGLs, if applicable, also needs to be included (i.e., justification for why Centrus believes it does not need to use site-specific DCGL values).

ACO Response:

Section V.b of the Decommissioning Plan contains this response.

c. Justification for why enriched uranium is not addressed.

ACO Response:

Section V.b of the Decommissioning Plan contains this response.

d. A description of the RESRAD-BUILD analysis used to derive the proposed DCGLs with justification for the parameter values used.

ACO Response:

Section V.b of the Decommissioning Plan contains this response.

e. A discussion as to whether the proposed DCGL values are intended to be used for the entire site (each survey unit) or only in specific locations (e.g., only walls or ceiling).

ACO Response:

Section V.b of the Decommissioning Plan contains this response.

f. The basis for using any unrestricted release screening criteria including a discussion of where screening criteria will be used and where Centrus proposes to use site-specific DCGLs for the FSS. For example, the DP's Section V.a., Unrestricted Release Using Screening Criteria, mentions the use of DandD and look-up tables in the DP as a screening method but no details are provided documenting the basis for their use (or whether they were actually used), the results of these analyses, and their impact on possible decommissioning or licensing decisions being made. It should be noted that Centrus must clarify which approach (screening vs. site-specific DCGL) it plans to use because both cannot be used for the FSS.

ACO Response:

Section V.b of the Decommissioning Plan contains this response.

g. A description of the average member of the critical group and an evaluation of the reasonably foreseeable use scenario. If residual material is present in the air ventilation system, drains, and underground lines, and it is not going to be removed, Centrus must measure (or conservatively estimate) the concentrations of the remaining material and perform an analysis that demonstrates that the release criteria will be met considering all reasonably foreseeable use scenarios.

ACO Response:

Section V.b of the Decommissioning Plan contains this response.

h. A summary of Centrus' as low as reasonably achievable evaluations for unrestricted use and potential future land use/exposure scenarios.

ACO Response:

Section I of the Decommissioning Plan contains this response.

4. Environmental Review

Please provide the following information to support NRC's environmental review of the DP.

a. Environmental information that would allow NRC to conduct an Environmental Assessment (EA) of the decommissioning activities conducted under an approved DP or justification for why an EA should be excluded under 10 CFR 51.22 as indicated in Centrus' DP transmittal letter to the NRC dated March 1, 2017 (Agencywide Documents Access and Management System Accession Number ML17067A192). In its March 1, 2017 transmittal letter, Centrus states that the DP was developed using the guidance in NUREG-1757, and that Decommissioning Group 4: Unrestricted Release with Site-Specific Dose Analysis and No Groundwater Contamination from the NUREG-1757 facility group classification was conservatively selected based on circumstances at the Lead Cascade Facility. NRC notes that in accordance with Table 15.3 of NUREG-1757 (Vol. 1), an EA is required for facilities under Decommissioning Group 4. However, in Enclosure 1 to its DP transmittal letter, Centrus states that a new EA "should be excluded under [10 CFR] 51.22."

   If an EA is needed, provide a revised Environmental Report to address the potential environmental impacts of decommissioning as discussed in the preceding requests. If a categorical exclusion is being requested, provide the specific regulatory citation under 10 CFR 51.22 that applies with justification.

ACO Response:

Section VI. of the Decommissioning Plan contains this response.

b. An update on consultation or communication with the Ohio State Historic Preservation Office (Ohio SHPO) regarding decommissioning of the Lead Cascade Facility. In the DP, Centrus notes that the Ohio SHPO had determined that the Portsmouth Gaseous Diffusion Plant (PORTS), within which the Lead Cascade Facility is located, meets the National Register Criteria for Evaluation (36 CFR 60.4) Criterion A because of the site's significance in the development of nuclear energy potential in post-World War II U.S. history and that the PORTS may be considered for addition to the National Register at some point in the future.

   In the NRC's consultation with the Ohio SHPO for the recent approval of the shipment of classified and/or contaminated material to the DOE's Nevada National Security Site for disposal, the Ohio SHPO expressed concern regarding potential impacts to the PORTS reservation. The concern expressed is that "decommissioning work sets in motion direct and foreseeable consequences that will result in substantial change" to the PORTS.

   If no consultation or communication has occurred, Centrus is encouraged to contact the Ohio SHPO so as to provide an accurate description of anticipated decommissioning activities and to discuss the effect on the historic nature of the PORTS and specifically the Ohio SHPO's finding under Criterion A.

ACO Response:

Section VI. of the Decommissioning Plan contains this response.

5. Decommissioning Activities

Please provide the following information related to Lead Cascade Facility decommissioning activities.

a. A summary in the proposed DP of the decommissioning activities that have been and will be completed under the current license authorization (dismantlement, size reduction, controls, waste disposal, etc.). This information is needed to determine the acceptability of Centrus' FSS design. The summary should include the following information with emphasis on items iii and vi:

   i. description of the type of activity,
   ii. where the activity occurred,
   iii. level of contamination generated and the potential for cross contamination of areas classified as non-impacted and impacted (Class 1, 2 and 3),
   iv. type of waste generated,
   v. volume of waste generated, and
   vi. whether any waste will be present in the area at the start of the DP authorized activities and if so, its status (packaged ready for shipment, open container, etc.).

ACO Response:

Section VII of the Decommissioning Plan contains this response.

b. A summary of the activities for which Centrus is requesting authorization to accomplish under the DP to include, as applicable, the methods of remediation (reduction of levels of radiological contamination above the $DCGL_w$[2] and associated waste volumes and waste disposal strategy).

ACO Response:

Section XIV.a of the Decommissioning Plan contains this response.

c. Identification of any new processes/procedures that resulted from Title 10 of the *Code of Federal Regulations* (10 CFR) 70.72 evaluations that will remain in effect after the approval of the DP and Centrus' commitment to tie them to the license.

ACO Response:

Section VIII.e of the Decommissioning Plan contains this response.

d. Identification with rationale of any license condition and documents tied to the current license that will no longer be applicable under the DP.

ACO Response:

Section VIII.e of the Decommissioning Plan contains this response.

6. Financial Assurance

Please provide the following information in the Decommissioning Funding Plan (DFP).

a. The amount of source term remaining to be removed, who will perform the removal, and the associated costs. Although costs are included for dispositioning Lead Cascade Facility equipment, costs are not provided for dispositioning the source term inventory.

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2 As defined in NUREG-1757

ACO Response:

Section XV.a. of the Decommissioning Plan contains this response.

b. Justification for why the cost associated with disposition of Uranium Hexafluoride (UF_6) is not included in the cost estimate. The UF_6 would generally fall into either licensee-owned or customer-owned. Centrus must clarify and provide a detailed justification as to whether the material in question is licensee-owned or customer-owned. The DFP on Page 4 states: "There are no decommissioning costs associated with disposition of UF_6 since the Licensee intends to utilize this material in future enrichment operations or will be transferred to an authorized facility during decommissioning." For further guidance on this topic, please refer to NRC's letter to the Nuclear Energy Institute dated January 25, 2017 (Agencywide Documents and Management System Accession Number ML16307A014).

ACO Response:

Section XV.a. of the Decommissioning Plan contains this response.

c. Identify or reference in the DFP who has the responsibility for long-term security for the Lead Cascade Facility site and identify the document that defines that responsibility.

ACO Response:

Section VIII.b. of the Decommissioning Plan contains this response.

d. Identify the costs for loading, transportation and an end destination for source materials in the cost estimate or identify how the costs are already covered by a third party (for example, Centrus' customer retains title to the material and is contractually responsible for loading and shipping costs back to the customer's site -which is a licensed site that can accept the material under its license).

ACO Response:

Section XV.a. of the Decommissioning Plan contains this response.

7. Decommissioning Schedule

Please provide the following information to show that Centrus will complete decommissioning in a timely manner.

a. A statement in the DP that the schedule is contingent on NRC approval of the DP.

ACO Response:

Section VIII.e. of the Decommissioning Plan contains this response. Additionally, Appendix D, Section VIII.e. of the Decommissioning Plan provides the updated decommissioning schedule.

b. A statement in the DP acknowledging that circumstances can change the decommissioning schedule and that Centrus will provide an updated schedule and amend the license as necessary if Centrus determines that the decommissioning cannot be completed as outlined in the submitted schedule.

ACO Response:

Section VIII.e. of the Decommissioning Plan contains this response.

Enclosure 3 of ACO 18-0001

Appendix A of the Decommissioning Plan (DP-2605-0001)

Information Contained Within
Does Not Contain
Export Controlled Information

Reviewing Official: ECI Reviewer #152

Date: 01/04/2018

Appendix A

Decommissioning Plan Cost Estimate

Information Contained Within
Does Not Contain
Export Controlled Information

Reviewing Official: ECI Reviewer #152

Date: 01/04/18

Table A3.4 Facility Description Summary

NRC License Numbers and Types (i.e., Parts 30, 40, 70, or 72)

- 10 CFR Part 70 - To possess and use special nuclear, source, and by-product materials.

Types and Quantities of Materials Authorized Under the Licenses Listed Above.

- 250 kg UF_6 (Uranium Hexafluoride)

Description of How Licensed Materials Are Used.

- Support of the test facility (Lead Cascade); cascade will be on 'Recycle' operations, where the enriched stream is recombined with the depleted stream; no enriched product will be withdrawn, except for laboratory samples necessary to confirm the machine's enrichment performance.

Description of Facility, Including Buildings, Rooms, Grounds, and Description of Where Particular Types of Materials Are Used.

X-7726 Centrifuge Training and Test Facility (CTTF) – The CTTF was the area where material and components were received/shipped; components or subassemblies were inspected and tested; the components were assembled as centrifuge machines; the final assembly was evacuated and leak checked; and repairs were performed to the machine or subassemblies. As part of the decommissioning phases of the Lead Cascade, centrifuge machines were disassembled (with free liquids removed) and reassembled in a manner to convert them into waste disposal containers (non-operational machines).

X-7725 Recycle/Assembly (R/A) Building - Small area of a larger, multiple level building to allow the temporary storage or movement of completed centrifuge machines from the X-7726 facility to the X-7727H Transfer Corridor. The X-7725 Buffer Storage Area was also used for receipt, shipping, storage, handling, and assembly/disassembly preparation activities of centrifuge components. Areas of the X-7725 building were used for shipping, receiving, and storage of materials, items, and waste containers for disposal.

X-7727H Transfer Corridor - Area that provides an enclosed throughway from the X-7725 building or X-7726 facility to the X-3001 Process Building (Lead Cascade Area). As part of the decommissioning phases of the Lead Cascade, this corridor was used to store centrifuge casings converted into waste disposal containers prior to shipment.

X-3001 Process Building – Train 3 area housed the Lead Cascade operations. The Lead Cascade was supplied normal (approximately 0.711 wt. percent U^{235}) UF_6 feed material from a cylinder located on a portable cart, also located in this area. Train 6 area is being used as a Radioactive Material Storage area during the decommissioning phases. The building was also used to accumulate and stage/prepare radioactive, mixed, hazardous, and non-hazardous recyclable materials prior to shipment offsite or transfer to the XT-847 facility.

X-3012 Process Support Building - Area that housed the Area Control Room, maintenance shops and stores, and other support areas.

X-3002 Process Building - Area temporarily used during the decommissioning shipping campaign for inclement weather conditions to allow for loading of trailers and vehicle transport surveys to be performed. Building corridor and the South half of Train 4 were used for these decommissioning efforts.

Quantities of Materials or Waste Accumulated Before Shipping or Disposal.

- Efforts have been completed; therefore, is not included.

Table A3.5(A) Number and Dimensions of Facility Components (Total Area)

COMPONENT	Number of Components	Dimensions of Components /Area (specify units) [1]	Total Area (ft^2) [1]	Level of Contamination[6]
X-3001		416' x 730'		
Floor (entire building footprint)	1 Building	303,680 ft^2		
Floors[1] (PB Train 3 area) [104' x 315']	1 Area	32,760 ft^2	32,760	Low Alpha
Floors[1] (PB Utility Bay area) [50' x 416' * 25%]	1 Area	5,200 ft^2	5,200	Low Alpha
Floors[1] (PB Train 6 area) [104' x 315']	1 Area	32,760ft^2	32,760	Low Alpha
X-3012		240' x 201'		
Floor (entire building footprint)	1 Building	48,240 ft^2		
Maintenance Shop	1 Area	280' x 106'	29,680	Low Alpha
Floors (Corridor)	1 Area	30' x 106'	3,180	Low Alpha
X-7725		540' x 820'		
Floor (entire building footprint)	1 Building	442,800 ft^2		
Buffer Storage[2]	1 Area	~208' x 283'	64,946	Low Alpha
Room 373	1 Area	6,360 ft^2	6,360	Low Alpha
X-7726		286' x 84'		
Floor (entire building footprint)	1 Building	24,024 ft^2		
Floors (multiple levels)[3]	1 Building	28,074 ft^2	28,074	Low Alpha
X-7727H		~750' x 30'		
Floors[4]	1 Building	26,078 ft^2	26,078	Low Alpha
X-3002				
Floors (South half of PB Train 4)	1 Area	104' x 140'	14,560	Low Alpha
Floors (Corridor)	1 Area	416' x 30'	12,480	Low Alpha
Total Area[5]			**256,078**	

Dimensions - amount listed is general ground floor area and may not equate to a straight area calculation (1*w).

Note 1: Areas include Lead Cascade 'Operational' area (Train 3 specific) = 32,760 ft^2 and 25% Process Building (PB) Utility Bay/Mezzanine area = 5,200 ft^2 and the proposed and the radioactive material storage area (Train 6) = 32,760 ft^2 for a Total = 70,720 ft^2.

Note 2: Area includes Buffer Storage, passage way, centrifuge staging, transfer corridor (= 58,864 ft^2) plus maintenance and battery charging area (= 6,082 ft^2) for a Total = 64,946 ft^2.

Note 3: Area includes CTTF floor area (= 24,024 ft^2) plus centrifuge machine assembly stand area (x5 levels > floor at approximately 30' x 27') (= 4,050 ft^2) for a Total = 28,074 ft^2.

Note 4: Area includes Transfer Corridor floor area (= 22,500 ft^2) plus X-3001 Process Building transitional area (= 3,578 ft^2) for a Total = 26,078 ft^2.

Note 5: Percentages/Areas listed are total facility areas considered and the realistic probability of floor space needing potential Decontamination, based upon relationship of area with radiological material or process. Anticipated areas of decontamination are much less, but this value was used to determine resources necessary.

Note 6: The use of "High" and "Low" Alpha refers to the anticipated levels of equipment contamination. "High" means that the contamination levels are greater than a 'free release' criteria, though as a conservative measure, all areas are treated as contaminated.

Table A3.9 Final Radiation Survey
(Productive Work Days)

Group	Type	# Workers	Dur (#d)	Avail Factor	Total (md)
Supervision	Exempt	0	0	219	0
Engineering	Exempt	1	64	219	64
Operations	Exempt	0	0	219	0
	Non-Exempt	0	0	219	0
Maintenance	Exempt	0	0	219	0
	Non-Exempt	0	0	219	0
Support	Exempt	1	64	219	64
	Non-Exempt	3	64	219	192
Totals		**5**			**320**

Assumptions:

- Anticipated duration = ~3.5m or 64 work-days
- Availability Factor = average annual work days = 219 md/y = 260 - 41(Paid Absences)

Anticipated tasks considered:

- Develop/Implement survey plans
- Collect/Analyze data
- Perform confirmatory surveys
- Develop final survey report
- NRC terminates license

Table A3.11 Total Work Days by Labor Category

Task	Labor Category Supervision (E)	Labor Category Engineering (E)	Labor Category Operations (E)	Labor Category Operations (N)	Labor Category Maintenance (E)	Labor Category Maintenance (N)	Labor Category Support (E)	Labor Category Support (N)	**Total Labor**
Planning and Preparation	0	0	0	0	0	0	0	0	**0**
Decontamination or Dismantling of Radioactive Facility Components	0	0	0	0	0	0	0	0	**0**
Restoration of Contaminated Areas on Facility Grounds	0	0	0	0	0	0	0	0	**0**
Final Radiation Survey	0	64	0	0	0	0	64	192	**320**
Site Stabilization and Long-Term Surveillance	0	0	0	0	0	0	0	0	**0**
Total by Category	**0**	**64**	**0**	**0**	**0**	**0**	**64**	**192**	**320**

Assumption:

- Individual tables describe other assumptions; this table is a summation of previous table information categorized by Exempt and Non-Exempt per phase.

Note:
Planning and Preparation Task, Decontamination or Dismantling of Radioactive Facility Components Task, and Restoration of Contaminated Areas on Facility Grounds Task have all been completed; therefore, no costs remain for these tasks.

Table B3.12 Worker Unit Cost Schedule

This Table is withheld pursuant to 10 CFR 2.390 and is located in Appendix B of this Decommissioning Plan

Table B3.13 Total Labor Costs by Major Decommissioning Task

This Table is withheld pursuant to 10 CFR 2.390 and is located in Appendix B of this Decommissioning Plan

Table A3.16 Laboratory Costs

Phase	Activity	# Workers	# Yr	Routine Freq (Samples/y)	Recall Freq (Samples/y)	Incident Freq (Samples/y)	Sample Factor	Unit Cost ($)	Total Cost
1	Planning and Preparation	0	0	4	0.2	2	6.2	163.00	$ -
2	Decontamination or Dismantling of Radioactive Facility Components	0	0	12	0.6	6	18.6	163.00	$ -
3	Restoration of Contaminated Areas on Facility Grounds	0	0	12	0.6	4	16.6	163.00	$ -
4	Final Radiation Survey	5	0.292	12	0.6	4	16.6	163.00	$ 3,950
5	Site Stabilization and Long-Term Surveillance	0	0	4	0.2	2	6.2	163.00	$ -
TOTALS		**5**							**$3,950**
TOTAL (Rounded, M)									**$0.00**

Assumptions:

- The utilization of the 'On-Site' laboratory facility is anticipated; therefore, there are no associated transportation costs included in the derivation of the Unit Cost.
- Routine Frequency is the anticipated number of samples per individual per year (see Table 4.7-3 of the Lead Cascade License Application).
- Recall Frequency assumes 5% recall rate; Recall = an individual sample submitted when analysis results exceed a predetermined urinalysis program action level (see Table 4.7-3 of the Lead Cascade License Application).
- Incident Frequency assumes 2 samples submitted for each incident; Incident = a special sample submitted for analysis due to an incident (for example, a personnel contamination event or an airborne release of radioactive material event occurs).
- Sample Factor = Routine freq + Recall + Incident; Total Cost = (# workers/phase) * (# yr) * Sample Factor * Unit Cost.
- # samples = (# workers/phase) * (Routine freq + Recall + Incident) * # yr.
- Analytical Unit Cost = $163 / sample [Amount based for uranium isotopic analysis and includes analysis performance, laboratory work, as well as Quality Assurance/Quality Control labor, and cost of materials plus overheads] (Values in note are $CY2016 escalated to $CY2017 by factor 1.0160).

Note:
Planning and Preparation Task, Decontamination or Dismantling of Radioactive Facility Components Task, and Restoration of Contaminated Areas on Facility Grounds Task have all been completed; therefore, no costs remain for these tasks.

Table A3.17 Miscellaneous Costs

Other Direct Costs

Cost Item	Total Cost
Miscellaneous Material for DeCon[1]	$36,441
Total	**$36,441**
Total (Rounded, M)	**$0.04**

Note 1: Estimate based upon percentage of Decommissioning Cost subtotal (1.5% * Total Other Indirect Costs [Table A3.18 = Indirect Services + Packaging/Shipping & Waste Disposal + Equipment + Laboratory + Other Indirect Costs]) [0.015 * (Total Other Indirect Costs); factor then rounded].
Note 2: Planning and Preparation Task, Decontamination or Dismantling of Radioactive Facility Components Task, and Restoration of Contaminated Areas on Facility Grounds Task have all been completed; therefore, no costs remain for these tasks.

Other Indirect Costs

Cost Item	Total Cost
NRC Staff Review and Approval DP[2]	$160,000
Taxes[3]	$ -
Total	**$160,000**
Total (Rounded, M)	**$0.16**

Note 3: Estimate based upon review and approval for Decommissioning Plan (DP). Inflation Index - [See Reference A in Table A3.15].
Note 4: Estimate based upon procured items [Total Table A3.15 * 7.25% tax rate]. All equipment costs from Table A3.15 have been spent and is no longer needed for the remaining cost estimate.

Table A3.18 Total Decommissioning Costs

Ref	Task	Calculated Costs ($2017, M)	Approximate Percentage
B3.13	Planning and Preparation[3]	-	0%
B3.13	Decontamination or Dismantling of Radioactive Facility Components[3]	-	0%
B3.13	Restoration of Contaminated Areas on Facility Grounds[3]	-	0%
B3.13	Final Radiation Survey	$0.19	6%
B3.13	Site Stabilization and Long-Term Surveillance	-	0%
	Cost of Third Party Use[1]	$0.26	9%
	Indirect Services	$2.27	78%
B3.14	Packaging, Shipping, and Waste Disposal Costs[3]	-	0%
A3.15	Equipment/Supply Costs[3]	-	0%
A3.16	Laboratory Costs	$0.00	0%
A3.17	Other Direct Costs	$0.04	1%
A3.17	Other Indirect Costs	$0.16	6%
	Subtotal[1]	**$2.92**	**100%**
	Contingency[2]	$0.73	
	Total Decommissioning Cost Estimate	**$3.65**	

Note 1: An adjustment has been applied to account for the "Use of a Third Party" contractor for performing each task scope. The adjustment includes an Overhead rate of 110% on Total Labor plus Contractor Profitability of 15% on Total Labor and Overhead. This is a different methodology than previously employed on using General & Administrative and Contractor Profitability on the entire Subtotal.

Note 2: Contingency assumed to be 25% on subtotal.

Note 3: Planning and Preparation Task; Decontamination or Dismantling of Radioactive Facility Components Task; and Restoration of Contaminated Areas on Facility Grounds Task; Packaging, Shipping, and Waste Disposal Costs; and Equipment/Supply Costs have all been completed; therefore, no costs remain for these tasks.

Table A3.19 Total Labor Distribution

Group	Type	Job/Personnel/Benchmark Descriptions
Supervision	Exempt	Project Manager
Engineering	Exempt	Design Engineer, Systems Engineer, Nuclear Engineer, Nuclear Safety (NS) Engineer, Engineer (Regulatory)
Operations	Exempt	Production Supervisor
	Non- Exempt	Hazardous Materials Technician
Maintenance	Exempt	Maintenance Supervisor, Scheduler/Planner
	Non- Exempt	Mechanic, Groundskeeper
Support	Exempt	Health Physics (HP) Supervisor, Waste Engineer, Buyer
	Non- Exempt	HP Technician, Security Officer – Armed

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