SUBJECT: AREVA NP Inc. Mount Athos Road Decommissioning Plan

(2) NRC letter, “Receipt of your Notice to Cease Licensed Activities and of Your Request to Postpone Initiation of Decommissioning Process under SNM—1168, Docket No. 70-1201”, dated October 29, 2010

ENCLOSURES: (I) Decommissioning Plan

Dear Mr. Thompson:

On August 5, 2010 AREVA met with members of the NRC and the Commonwealth of Virginia Department of Health at NRC Region II in Atlanta. The purpose of the meeting was primarily to discuss AREVA’s plans to move the fuel manufacturing portion of the site operations, the planned decontamination of the Special Nuclear Material (SNM) contact area and the continued by-product material handling activities.

On August 25, 2010 AREVA submitted written notification of plans to cease fuel manufacturing and the use of special nuclear material associated with fuel manufacturing on or about July 2011, reference 1. Additionally, AREVA requested the postponement of the initiation of the decommissioning process to support the continued by-product material operations and the plan to transfer residual SNM contamination to the Commonwealth of Virginia License.

On October 29, 2010 the NRC by reference 2 replied to the August 25th letter. The NRC acknowledged August 25, 2010 as the notification date and consistent with Title 10 of the Code of Federal Regulations (10 CFR) 70.38(d) noted that a decommissioning plan should be submitted to the U.S. Nuclear Regulatory Commission (NRC) on or before August 25, 2011, for review and approval.

The NRC acknowledged AREVA’s intention to conduct other activities under the Commonwealth of Virginia license in the same space currently used for fuel manufacturing. The NRC requested that the decommissioning plan to be submitted should address how AREVA intends to decommission this space with this future use as an objective and consistent with 10 CFR70.38.

Based on the actions described above, AREVA has prepared the enclosed decommissioning plan.

Since the site currently handles by-product material under the Commonwealth of Virginia license and will continue to do so, the decommissioning of the fuel manufacturing operation presents a special case with respect to typical decommissioning and the guidance documents that outline acceptable approaches to decommissioning.

AREVA NP INC.
An AREVA and Siemens company
1724 Mount Athos Road, PO Box 11646, Lynchburg, VA 24506-1646
Tel.: (434) 832-5205
SUBJECT: AREVA NP Inc. Mount Athos Road Decommissioning Plan

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DECOMMISSIONING PLAN FOR THE AREVA MOUNT ATHOS ROAD FUEL PLANT

SNM-1168
Docket 70-1201

JANUARY 2011

AREVA

AREVA NP INC.
An AREVA and Siemens company
1724 Mount Athos Road, PO Box 11646, Lynchburg, VA 24506-1646
Tel.: (434) 832-5205
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<tr>
<th>Acronym</th>
<th>Definition</th>
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</thead>
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<tr>
<td>ALARA</td>
<td>As low as is reasonably achievable</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>DCGLs</td>
<td>Derived Concentration Guideline Levels</td>
</tr>
<tr>
<td>DP</td>
<td>Decommissioning Plan</td>
</tr>
<tr>
<td>DFP</td>
<td>Decommissioning Funding Plan</td>
</tr>
<tr>
<td>dpm</td>
<td>disintegrations per minute</td>
</tr>
<tr>
<td>EHS&amp;L</td>
<td>Environment Health and Safety and Licensing</td>
</tr>
<tr>
<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
</tr>
<tr>
<td>FSS</td>
<td>Final Status Survey</td>
</tr>
<tr>
<td>HEPA</td>
<td>high-efficiency particulate air</td>
</tr>
<tr>
<td>IROFS</td>
<td>Items Relied on for Safety</td>
</tr>
<tr>
<td>LLRW</td>
<td>low-level radioactive waste</td>
</tr>
<tr>
<td>μCi/ml</td>
<td>microcuries per milliliter</td>
</tr>
<tr>
<td>mrem</td>
<td>millirem</td>
</tr>
<tr>
<td>MSL</td>
<td>Mean Sea Level</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>NRC</td>
<td>U.S. Nuclear Regulatory Commission</td>
</tr>
<tr>
<td>pCi</td>
<td>picocurie</td>
</tr>
<tr>
<td>PLR</td>
<td>Pellet Loading Room</td>
</tr>
<tr>
<td>QA</td>
<td>Quality Assurance</td>
</tr>
<tr>
<td>REMP</td>
<td>Radiological Environmental Monitoring Program</td>
</tr>
<tr>
<td>SNM</td>
<td>special nuclear material</td>
</tr>
<tr>
<td>TEDE</td>
<td>Total Effective Dose Equivalent</td>
</tr>
<tr>
<td>UO₂</td>
<td>uranium dioxide</td>
</tr>
<tr>
<td>USGS</td>
<td>U.S. Geological Survey</td>
</tr>
<tr>
<td>VOC</td>
<td>volatile organic compound</td>
</tr>
</tbody>
</table>
REFERENCES


3. NRC, Special Nuclear Material License SNM-1168


5. BAW-1412, Babcock and Wilcox Commercial Nuclear Fuel Plant Environmental Report, 1974


PREFACE

This Decommissioning Plan (DP) was prepared using the guidance in NUREG-1757 (Ref. 1) as well as other applicable or relevant documents and guidance identified in the reference section of this DP.

Pursuant to the NRC regulations, the DP must designate whether the licensee intends to decommission the site for unrestricted use or whether some future restrictions will be included. AREVA’s intention and objective is to decontaminate the fuel manufacturing areas that handle special nuclear material. The decontamination will be to a level consistent with the Commonwealth of Virginia license for surface fixed and removable residual contamination. Additionally the residual mass of SNM remaining in subsurface pipes will be quantified and demonstrated to be less than the values authorized under the agreement state program.

When the objective is met (residual SNM is less than 10 CFR 150 values), the residual SNM will be transferred to the Commonwealth of Virginia License and the SNM license terminated.
1 Executive Summary

SNM licensed activities performed at the AREVA Lynchburg facility are scheduled to relocate to the Richland facility. As part of the relocation, the fuel plant will cease the production of nuclear fuel in the first quarter of 2011.

AREVA plans to terminate the SNM license and continue operations associated with the Commonwealth of Virginia license. Since licensed activities with radioactive material will continue on the site and specifically in the fuel fabrication building, the proposed decommissioning does not follow the traditional approach.

The planned approach is to remove the bulk uranium, decontaminate and/or dispose of the uranium contaminated equipment and building surfaces, and perform surveys demonstrating that the residual radioactivity as contamination is consistent with the Commonwealth of Virginia license and less than 350 grams of $^{235}$U.

AREVA plans to start decommissioning on or about April 1, 2011 and start using by-product material in the fuel plant on October 1, 2011. During the six months between the completion of fuel fabrication and use of the building for by-product material, the residual uranium will be cleaned up and any remaining residue in the piping system and pellet loading room quantified.

1.1 Site and Licensee Information

The facility is located in the State of Virginia in Campbell County as shown in Figure 1. The location of the facility with respect to the City of Lynchburg is shown in Figure 2.

The facility is located on an approximately 70 acre site in Campbell County approximately 4 miles from the Lynchburg city limits. The site is adjacent to the Babcock and Wilcox site. The physical layout of the site is as shown in Figure 4.

The site is adjacent to state route 726. There are no interstate highways nearby.
Figure 1 Virginia Map

Figure 2 Facility Location
Name and Address of Licensee
AREVA NP, Inc.
1724 Mount Athos Road
PO Box 11646
Lynchburg, VA 24506-1646

State of Incorporation:
AREVA NP, Inc. is a wholly owned subsidiary of AREVA Inc. The relationship is organized and exists under the laws of the State of Delaware.

Correspondence pertaining to this license should be addressed to:

Dominique Grandemange
AREVA NP, Inc.
1724 Mount Athos Road
PO Box 11646
Lynchburg, VA 24506-1646

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E-mail Dominique.grandemange@areva.com
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1.2 Summary of Licensed Activities
In 1969 the AEC issued Babcock & Wilcox (AREVA predecessor) an SNM license for the fabrication of low enriched nuclear fuel. For most of the plant life the manufacturing operation included the receipt of pressed UO₂ pellets through the assembly and shipping of finished fuel assemblies. For a relatively short period, 1975 to 1982, the facility was licensed to process UO₂ powder and performed pelletizing and associated processes in the south end of the fuel plant. This part of the operation was terminated, the area decontaminated and it is now used for final fuel assembly. With the exception of the pelletizing operation described in section 2.3.2, the handling of unclad uranium has been confined to the pellet loading room (PLR).

Since 1971, operations with by-product material have expanded and now are the dominant activity of the facility. These operations are performed under the Commonwealth of Virginia license and will continue into the foreseeable future.

1.3 Nature and Extent of Site Radiological Contamination
For the purpose of this plan the nature and extent of contamination is described for SNM licensed by the NRC and does not include the Commonwealth of Virginia licensed material.
1.4 Decommissioning Objective

It is the objective of AREVA to decommission the SNM areas of the site in a manner that is consistent with the license requirements and NRC regulations so that limited residual SNM can be transferred to the Commonwealth of Virginia by-product material license and the SNM-1168 license terminated.

1.5 Site-Specific DCGLs

Site specific DCGLs are not planned to be developed until the final decommissioning of the site under the Commonwealth of Virginia license at some time in the future. The development of DCGLs for a site with multiple radionuclides of which many are not associated with the SNM license is not practical considering the continued operation and handling of radioactive material. Since DCGLs are derived contamination levels based on dose, all radionuclides that are significant contributors to the TEDE to the average member of the critical group need to be considered.

In addition to the radionuclides described above, the exposure scenario today (industrial use) will likely be different than a future exposure scenario (such as resident farmer). As a result of these major factors in determining DCGLs, it will be more practical to calculate these values at the end of all licensed activities under the Commonwealth of Virginia License.

In lieu of site specific DCGLs, a control value of 30 pCi/g total uranium for volumetric contamination will be used if needed. This value is based on the former Branch Technical Position paper DISPOSAL OR ONSITE STORAGE OF THORIUM OR URANIUM WASTES FROM PAST OPERATIONS, October 23, 1981 and the release of other land areas of the AREVA site from NRC control at these levels. Based on similar facilities, this value appears to be conservative for uranium; however it is recognized that site specific factors greatly influence the derived value.

Since surface contamination levels will be subject to the Commonwealth of Virginia license, these values derived from reference 4 will be used in lieu of generating site specific DCGLs for residual surface contamination.

1.6 ALARA Analysis

The decontamination of the fuel plant will be performed using the ALARA principle as described in section 4.2 of reference 3. The residual contamination levels described will continue to be controlled by the facility under the Commonwealth of Virginia license. These levels would present a negligible increase to the site dose relative to continuing operations that meet the ALARA principle for an operating site.
1.7 Start and End Dates

![Project Timeline Diagram]

Figure 3 Project Timeline

1.8 Post-Remediation Activities

No post-remediation activities have been identified. The site will be maintained under the Commonwealth of Virginia license during the continued operation of the services business and ultimately decommissioned consistent with the Commonwealth of Virginia requirements.

1.9 Amendment to License to Incorporate DP

AREVA is requesting that the NRC amend License No. SNM-1168 to incorporate this DP.
2 Facility Operating History

2.1 License Number/Status/Authorized Activities

The fuel manufacturing operation license is SNM-1168, Docket 70-1201. The license was last renewed for 10 years and expires on August 30, 2013.

The authorized activities include:

Fabrication of nuclear power fuel assemblies starting by inserting fuel pellets into rods, through fuel assembly bundling, packaging and delivery of fuel assemblies to a carrier for transport, and repair of returned assemblies. The handling and storage of materials resulting from the activity of fabricating nuclear power fuel assemblies.

Disposal of various solid, liquid, and airborne wastes resulting from the authorized activities excluding onsite burial.

Laboratory operations such as but not limited to chemical analysis, metallographic analysis and testing.

Storage of nuclear materials in various forms (uranium oxide pellets, pellet scrap, contaminated material, filters, downloaded cladding) and facilities appropriate to safety.

Activities of a process and product development nature.

Maintenance of the facilities and equipment under adequate control to assure safety.

Possession of authorized by-product, source, and special nuclear materials in packages approved pursuant to 10 CFR 71 for the purpose of delivery to a carrier for transport, and in private carriage between NRC licensed facilities within the United States.

Table 1 SNM-1168, Docket 70-1201 Amendment 16 possession limits

<table>
<thead>
<tr>
<th>6. Byproduct, Source, and/or Special Nuclear Material</th>
<th>7. Chemical and/or Physical Form</th>
<th>8. Maximum Amount that Licensee May Possess at Any One Time Under This License</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Uranium enriched (and enriched processed uranium containing plutonium and other transuranic isotopes) up to 5.1% U-235</td>
<td>A. Uranium oxide pellet or pellet scrap</td>
<td>A. 15,000 kilograms of U-235</td>
</tr>
<tr>
<td>B. Plutonium</td>
<td>B. Sealed Sources</td>
<td>B. 6 grams plutonium</td>
</tr>
<tr>
<td>C. Uranium enriched in U-235</td>
<td>C. Any</td>
<td>C. 350 grams U-235</td>
</tr>
<tr>
<td>D. Byproduct material and Plutonium</td>
<td>D. Contamination on/within equipment, tooling, and components and waste</td>
<td>D. 1,000 Curies total</td>
</tr>
</tbody>
</table>
2.2 License History

Babcock & Wilcox Power Generation Division applied for the initial SNM license on May 29, 1969 and the Atomic Energy Commission (AEC) approved the license on December 16, 1969. In December 1971 limited quantities of by-product material were licensed. The forms and quantities of by-product material increased over time especially with the growth of the field services businesses. In June 1970 the AEC approved the use of Source Material. Over the past 40 years, the ownership and name have changed several times and the facility is currently licensed as AREVA NP Inc. The SNM license expires in August 2013. Since the last license renewal the license has been amended 16 times. With the exception of the amendment removing by-product material, none of these amendments have an impact on the decommissioning approach and are not listed because of their minor significance.

In March 2009 the Commonwealth of Virginia took over responsibility for by-product material and on July 14, 2009 issued Radioactive Material License 680-515-1 for the possession and use of by-product material. This license expires on August 30, 2013. As part of the transition from NRC control to State control under the NRC Agreement State Program, the NRC amended SNM-1168 on October 30, 2009 by removing source and by-product material from the SNM-1168 license.
Figure 4, depicts the outdoor areas that were used for storing SNM. For several years empty UF₆ cylinders with heels were stored as shown in Figure 4.

2.3 Previous Decommissioning Activities

Throughout the history of the site numerous expansions, renovations, demolitions and excavations to site structures, systems and soils have occurred. The list below provides a summary of decommissioning and significant decontamination or survey projects supporting new facilities that have occurred.

2.3.1 Wet Weather Stream Decommissioning

The area commonly known as the wet weather stream was decommissioned in 1998. The NRC formally approved the release for unrestricted use of this area on April 3, 2000, reference 6. The wet weather stream was cleaned up to less than 30 pCi/ g total uranium average. The wet weather stream is the only true decommissioning project since the area was released by the NRC for unrestricted use.

2.3.2 1982-1983 Pelletizing Area Decontaminated

From 1975 to 1982 UO₂ pelletizing was performed in the south end of the fuel plant in the area now used for final fuel assembly. The operation was consistent with a typical modern fuel fabrication plant and included UO₂ powder receipt, mixing/blending, pre-compaction, granulating, pellet pressing, sintering and grinding. In 1982 the pelletizing operation was closed and the equipment was disposed as LLRW. The area was decontaminated to meet the license contamination limits.

![Change Rooms
Pelletizing
PLR](Image)

Figure 5 Former Pelletizing Operations Area

2.3.3 1986 Waste Water Line Repair

During construction of the fuel plant, a Vulcathene pipe was installed under the building foundation. Vulcathene is manufactured from co-polymer polypropylene with 3% carbon black ultra-violet stabilizer. Vulcathene has very high resistance to chemical attack and is well suited to the conveyance of aggressive chemicals, and other liquids as used in chemical plants and laboratory waste. The performance specification is based on the need to supply a waste system which has a high chemical resistance rating in respect of the corrosive materials which it has to convey. Vulcathene displays good tensile strength, ductility, abrasion resistance, high impact strength, weather resistance, and is stable over
the range of temperatures normally encountered in the environment in which it is used. The Vulcathene pipe ran the length of the fuel plant with multiple extensions, most of which were never used. The pipe drained into two 1,000 gallon retention tanks where the waste water was sampled, adjusted for pH, if needed, and discharged through a continuation of Vulcathene pipe to the wet weather stream. The pipe lays anywhere from about 3 feet below the foundation to approximately 10 feet below the ground surface. The pipe was used for water from several change room sinks and showers as well as the metrology laboratory sinks. Water from the pellet grinders was centrifuged and flocculated to remove uranium and also discharged to the piping system. The pipe system was not used for chemicals or uranium handling processes and only handled slightly contaminated water which was eventually discharged to the wet weather stream.

When discharges using the piping system ceased, the pipe was flushed with water. Sections of the system continued to be used for industrial waste water from the component cleaning process for several years after the use for potentially contaminated water from the uranium handling operations ceased. This continued use likely continued to clean these sections of pipe of any uranium deposits or contamination that remained from its operation period.

In 1986 a section of the Vulcathene waste water line was excavated and replaced with a polyethylene section. The pipe section was replaced after a noticeable increase in the quantity of waste water was being generated and collected at the retention tanks. The increased volume was due to ground water infiltration and the cause of the leak was determined to be from differential settling of the ground which was largely comprised of fill during the initial building construction. Figure 6 shows the area where the pipe was replaced.

![Figure 6 1986 Waste Water Line Repair](image-url)
2.3.4 1989 Waste Water Line Removal

On June 27, 1989 174.8 feet (including cleanout sections) of the 4 inch diameter Vulcathene liquid discharge line was excavated prior to construction of the building additions.

Figure 7 below shows the approximate location of the 1989 excavation and the building additions. As part of the project, 15 soil samples were collected along the pipe excavation and analyzed for isotopic uranium and VOCs, according to the report. Results of the radiological analysis were not found in the decommissioning file so a definitive determination of the radiological status cannot be made. The project file did not have any information which would indicate that the pipe leaked or there was contamination in the soil around the removed pipe.

![Figure 7 Waste Water Pipe System](image_url)

2.3.5 1996 SERF -1 decontamination

From 1990 to 1995 Fuel Field Services handled by-product material in the former pelletizing area (Figure 8). While in operation, contamination control techniques included the covering of surfaces that could be contaminated with plastic sheeting. As a result, residual contamination was minimal and the area was decontaminated and surveyed consistent with license levels and released for use as a non-contamination control area. It is noted in the survey documentation and interviews with staff members that this area has some residual radioactivity. The radioactivity is present in some of the floor seams and cracks and has been fixed in place with floor coatings. Since the
operations in this area did not involve liquids or solutions and there are no records of spills, it is unlikely that the contamination has penetrated the foundation floor.

2.3.6 2009 Waste Water Pipe and Retention Tanks

In July 2009 a section of the waste water pipe from the former retention tanks to just before the gas bottle storage area was excavated, see Figure 7. The internal sections of the pipe had detectable alpha and beta/gamma contamination. The alpha contamination is most likely from uranium and the beta/gamma from by-product material. In addition to the removal of the pipe, the remaining 1,000 gallon retention tank was removed and packaged for disposal. Areas of the retention tank concrete base that supported the retention tanks had several pockets of detectable contamination. These areas were removed and placed in waste boxes for disposal. Soil samples collected from the trench were analyzed for by-product, source and special nuclear material and the results were indistinguishable from background. Several years earlier the pipe section from the retention tanks to the wet weather stream outfall was removed as described in 2.3.1.

2.4 Spills

There are no records or indications of significant spills that could impact the current radiological state of the facility or environment. Leaks in the waste water line are discussed above in section 2.3.

2.5 Prior On-site Burials

There are no records or historical indications that indicate that radioactive material was buried on site.
3 Facility Description

3.1 Site Location and Description
The facility is located on an approximately 70 acre site in Campbell County, Virginia, approximately 4 miles from the Lynchburg city limits. The location of the facility is identified on Figure 1 and Figure 2. The site lies on a river bend bounded on three sides by the James River and on the southeastern side by Mt. Athos. The topography of the plant site is generally rolling with gentle slopes. The dominant topographic feature of the site is a hill located approximately at the center of the property, the crest of which rises to 211 m (693 ft) mean sea level (MSL). The site includes a large area of relatively flat floodplain adjacent to the river. The highest point in the vicinity of the site is the top of Mt. Athos, where the elevation is 271 m (890 ft) MSL.

The site is adjacent to state route 726. There are no interstate highways nearby.

The nearest body of water is the James River. The facility site lies on a river bend bounded on three sides by the James River and on the southeastern side by Mt. Athos.

3.2 Population Distribution
Census data from the U.S. Census Bureau for the 2000 census indicates that the population for Campbell County was 51,078. Population for the city of Lynchburg was 65,269.

Because of the terrain, most of the population within a 5 mile radius of the facility resides over 3 miles from the site. There are no significant clusters of population within a 2 mile radius of the facility. The closest inhabitants occupy residences, which are located about one-half mile to the ENE.

Approximately two-thirds of the population within 5 miles of the plant reside between the 3 and 5 mile radii in the WSW to WNW directions. This includes the eastern portions of the City of Lynchburg and the community of Madison Heights.

Within a 3 mile radius of the plant, there are only a few public facilities or business activities that attract large numbers. The neighboring B&W plant is the only other major industry in the immediate vicinity. Approximately 2,000 workers are employed at this plant. The Central Virginia Credit Union is located immediately next to the facility, at the intersection of Route 726 and the entrance to the B&W plant.

3.3 Current/Future Land Use
The current land area owned and used by AREVA is used for industrial activities associated with nuclear fuel fabrication and nuclear equipment and components services and refurbishment. The use includes storage of radioactive material and the operation of support facilities including a radiochemical analysis facility. The future land use is virtually unchanged since the current structures remain and the service business continues for the
foreseeable future. The relocation of the fuel manufacturing has little impact on the future land use and it is anticipated that future uses of the land around the site will remain consistent with its current use, i.e., residential, agricultural, and light industrial.

3.4 Meteorology and Climatology

The climate of the Lynchburg area is influenced by cold and dry polar continental air masses in the winter and warm and humid gulf maritime air masses in the summer. The mean temperature is about 13.7°C (56.7°F) with normal average temperatures ranging from 24.6°C (76.3°F) in July to 3.6°C (38.5°F) in December. Rainfall amounts at Lynchburg can be expected to reach 102.4 cm (40.3 in) in any given year. The monthly rates of rainfall are nearly uniform except for a slightly higher rate during the summer months. Snowfall in the Lynchburg area generally occurs between the months of December and March. The mean yearly snowfall total is 49.3 cm (19.4 in). Winds are predominately from the southwest with a mean speed of 12.8 km/h (8.0 mph). Mean relative humidity values at 7:00 a.m., 1:00 p.m., and 7:00 p.m. are 78.1, 51, and 62% respectively. Heavy fog can be expected to occur at the site on the average of 40 days per year.

Extremes in weather conditions in the area are rare. Severe weather at the site is generally limited to thunderstorms, with a low probability of tornados. Climatology data shows that the mean number of thunderstorms occurring in Lynchburg is 22 per year. Data obtained from the National Oceanic and Atmospheric Administration (NOAA) indicates that between 1950 and 1995 there were, on average, 6 tornadoes per year in the state of Virginia. Of those tornadoes, 2 per year were categorized as "strong-violent", equating to an F2 to F5 rating on the Fujita Tornado Damage Scale. NOAA data showed that between 1950 and 1995, tornadoes occurred at a rate of 1.6 tornadoes per year per 10,000 square miles in Virginia. This equates to an annual probability of 1.9 E-5 per year for the site.

3.5 Geology and Seismology

The James River Basin of Virginia includes portions of four physiographic provinces, each of which is characterized by distinct landforms and physical features. These provinces, located west to east, are Valley and Ridge, Blue Ridge, Piedmont and Coastal Plain. Western or inner Piedmont where the Mt. Athos site property lies is an upland characterized by scattered hills, some of mountainous dimensions, lying eastward from the foot of the Blue Ridge.

The central Appalachian region of Virginia is characterized by a moderate amount of low-level earthquake activity which appears as somewhat isolated "clusters" of seismic energy release; there is a central Virginia cluster, a western Virginia-West Virginia cluster and a northern Virginia-Maryland-West Virginia cluster. The facility is located in the western part of the central Virginia cluster region which is classified as Zone 2 on the Seismic Risk Map of the United States. On the Modified Mercalli (MM) scale this zone corresponds to an intensity of VII, which implies building damages to the extent of fallen chimneys and cracked walls. Zone 2 has an acceleration range of 0.065 to 0.14 gravity.

During the period 1758 through 1968, 121 earthquake epicenters in Virginia were reported. The largest earthquake was in 1897, with a probable epicenter in Giles County,
approximately 100 miles west of the plant site. A maximum intensity of VIII was estimated in the epicentral region, but an intensity of only V–VI was estimated for the facility site. For this earthquake the Lynchburg area reported it was perceptible with bricks falling from chimneys and furniture and houseware being jostled. The second largest earthquake was in 1875 with a maximum epicenter intensity of VII more than 50 miles east of the site. The estimated intensity at the site was V.

The facility site lies on a river bend bounded on three sides by the James River and on the southeastern side by Mt. Athos. Hence, the only waters that could be affected by plant operation or that could influence plant operation are the James River and the ground waters of the site and its immediate environs.

Facilities at the Mt. Athos site utilize several wells to obtain groundwater. These wells are situated in the northeastern portion of the property along the James River. Water levels at these wells are approximately 465 to 442 feet Mean Sea Level (MSL) and indicate the generally northerly downward-sloping trend toward the river.

Six borings and excavations at the site have revealed that the site is blanketed by a layer of dark brown sandy-clay topsoil which contains extensive root structures. The topsoil is approximately 0.15 to 0.45 m (6 to 18 in) thick and is underlain by strata 3 to 12 m (10 to 40 ft) thick of firm, primarily cohesive soils such as clay and silt loam. These cohesive soils lie above a stratum approximately 1.5 m (5 ft) thick of coarse sand, gravel, cobbles, and boulders, which in turn is underlain by highly weathered bedrock. The upper surfaces of the bedrock are irregular and may slope downward generally in a northerly direction. The unweathered bedrock was encountered at an elevation of approximately 158 m (520 ft) MSL around the site. Along the meandering bank of the river, much of the bedrock is heavily bracketed by alluvium. There have been no important mineral resources identified at the AREVA site, and there is no indication on the U.S. Geological Survey (USGS) topographic maps of significant surface or underground mining activities within 8 km (5 miles) of the site.
3.6 Surface Water Hydrology

The Mt. Athos site is located on a river bend and generally exhibits a rolling surface of gentle slopes. It is bounded on three sides by the meandering James River and on the southeastern side by Mt. Athos. The dominant topographic feature of the site is a hill located approximately at the center of the property, the crest of which rises to 693 feet MSL. The ground is inclined toward the river from the hilltop to the riverbank, which is at approximately 470 feet MSL. The highest point in the vicinity of the site is the top of Mt. Athos, where the elevation is 890 feet MSL. Surface water from the majority of the site drains into the fire pond which discharges to the wet weather stream and then the James River. Smaller surface water runoff paths are present and generally discharge on the north side of the fenced area.

3.7 Groundwater Hydrology

The site is situated in the Piedmont Physiographic Province. The site is underlain by clayey sands, sands and gravels and saprolite from the surface to approximately 15 to 60 feet below ground surface. The saprolite grades into a graphic schist bedrock of the Ordovician Age Archer Creek Formation.

Groundwater elevations in the shallow aquifer ranged from 550 feet above MSL on the south-southwest side of the property to 480 feet above MSL on the north-northeast side of the property. The shallow groundwater monitoring data indicated a flow direction towards the
north-northeast with an average linear velocity of 12 feet per year. The direction of groundwater flow in the deep zone was determined to be identical to that of the shallow zone. Surface water runoff in the vicinity of the property and from the roofs of the buildings is directed either to a 6.1 million gallon retention pond (fire pond) located on the northern side of the property where it is then discharged to the James River or to two outfalls which discharges storm water from the North-West corner of the site to the James River. Effective in the summer of 2011 the storm water discharges will be directed to the fire pond.

3.8 Natural Resources

The site is in an area that is not exploited for its natural resources such as minerals and ores; fuels, such as peat, lignite, and coal; hydrocarbons, including gas, oil, tar sands, and asphalt; geothermal resources or industrial mineral deposits, such as sand and gravel, clays, aggregate sources, shales; and building stone. Timber could be felled and agricultural lands are abundant surrounding the facility.

Exploitation of the limited resources near and surrounding the site would not affect the dose estimates for the scope of the planned decommissioning activities.

3.9 Ecology/Endangered Species

The site is surrounded by forested land, the James River, and an industrial site. The area has an abundant diversity of flora and fauna. A search of endangered species was not performed because of the nature and scope of the planned decommissioning activities which will not impact the ecology.

4 Radiological Status of Facility

4.1 Contaminated Structures

The MAR site has several structures that are contaminated as a result of handling radioactive material. For the purpose of this plan only the fuel plant handles unencapsulated SNM and contains residual SNM contamination. For the most part, the significant contamination is limited to the pellet loading room (PLR) including the vaults which represents a small area of the fuel plant and very small fraction of the overall site contaminated areas (see Figure 4).

Fixed contamination levels in the pellet loading room (contamination control area) are typically greater than the release limits and removable contamination levels in certain areas also exceed the release levels.

The former pellet plant and SERF-I area meets the removable contamination criteria and for the most part the fixed contamination criteria. Historic records indicate a few localized areas (cracks and crevices) with dose rates detectable above background. These areas were sealed to fix the radioactive material in place and prevent the spread of contamination.

The balance of the plant did not handle radioactive material in a dispersible form and based on routine surveys meets release criteria.
4.2 Contaminated Systems and Equipment

4.2.1 Ventilation

The pellet loading room (PLR) has a ventilation system as shown in Figure 10 that includes a recirculation portion and an extract portion. The ventilation system includes Pre and HEPA filtration. The ventilation system has been in service for many years and is likely contaminated internally above release criteria. There is the potential that minor accumulations of pellet chips may be present in small air flow pockets within the system. Based on operations with only pellets (no powder) and the routine surveys and inspection performed under the IROFS program, the total mass of uranium in the system is expected to be very low. Historically only gram quantities of uranium have been contained in the pre-filters and HEPA filters.

![Figure 10 Ventilation System](image)

4.2.2 Waste Water Piping

The waste water piping system was formerly used to collect slightly contaminated water from sinks and showers and discharged to the wet weather stream after measurement and...
dilution if required. Figure 7 provides a diagram of the waste water piping system. Based on preliminary measurements of the pipe, the total quantity of uranium contained in the piping system appears to be relatively low and much less than 350 grams of $^{235}\text{U}$. This is expected since the system was only used for water solutions containing part per million concentrations of uranium and the flushing of the system as discussed in section 2.3.3. Additional characterization and quantification will be performed for the piping system as described in section 8.2.

4.2.3 Equipment

The majority of the contaminated equipment is located in the pellet loading room. Contamination levels range from a few dpm/100cm$^2$ to over 100,000 dpm/100cm$^2$. This equipment will be removed from the PLR and will not be part of the end condition prior to terminating the license.

4.3 Surface Soil Contamination

Soil samples are routinely collected around the site as part of the radiological environmental monitoring program (REMP) and during special projects such as new construction. A sampling of environmental soil sample data indicate that the gross alpha concentrations in soil are typical of background at about 4 to 7 pCi/g. Annual gaseous airborne uranium effluent since 1997 has been about 4 uCi per year. At these quantities, coupled with the stack height and high volumetric flow rate, atmospheric settling on the facility grounds would be exceptionally small as demonstrated by the soil samples that are routinely collected.

4.4 Subsurface Soil Contamination

The uranium handling operations were performed using insoluble forms of uranium, greatly minimizing the potential for subsurface soil contamination that could occur if there were a leak of material. Additionally there were no known significant spills of uranium that could have caused subsurface contamination.

As noted in section 2.3.3, a section of the waste water line as shown in Figure 6 was damaged by differential settling of the soil and ground water infiltrated the piping system. It is possible that slightly contaminated water leaked in this underground area. When the pipe was excavated and replaced, soil sample were collected however the results of the sampling are not available. Based on interviews of staff members familiar with the project, contamination was not detected in the soil.

The waste water line was used for transferring slightly contaminated water to the retention tanks for sampling and dilution, if needed, prior to discharge to the wet weather stream within the regulatory limits at the time. Because the concentration of uranium was very low, even if water leaked from the pipe, the quantity is believed to be very low. This area will be identified in the decommissioning record and addressed at the time of facility decommissioning.
4.5 Surface Water

The James River, the fire pond and the wet weather stream are the major bodies of water on or adjacent to the site. Additionally two rain water discharge points exist on the north side of the facility. Environmental samples are routinely collected and demonstrate that there is no uranium contamination in the water bodies. Since the decommissioning of the wet weather stream, the plant has had a zero liquid discharge policy for potential radiological constituents.

4.6 Groundwater

Groundwater is typically not sampled for radioactivity on site because there is little potential for groundwater contamination.

There are a number of shallow and deep ground water monitoring wells that were historically installed to monitor for VOC contamination. This monitoring program is managed by B&W and is part of an EPA consent agreement. Figure 12 shows the location of several of these wells that are closest to the fuel plant and may be useful for groundwater sampling. Since the wells are available, AREVA plans to sample 4 of the wells (MW-3, MW-4, MW-5 and MW-10). These wells are down gradient from the waste water line and should be useful to help confirm that the pipe did not leak and that the groundwater is not impacted by the operations.

5 Dose Modeling Evaluations

5.1 Release Involving Alternate Criteria

As discussed, the Mount Athos Road Facility is somewhat unique since the majority of the radioactive material handling continues under the Commonwealth of Virginia License. The proposed approach to releasing the site from the SNM-1168 license is to demonstrate that the residual contamination in the piping system, when totaled over the length of the pipes, is less than 350 grams $^{235}\text{U}$ and that residual surface contamination is consistent with the byproduct license.

Dose modeling is not planned until the ultimate facility decommissioning at some indeterminate time in the future.

6 Environmental Report

During the 2002 license renewal, an environmental report was submitted as part of the renewal process. Since the planned activities have a negligible impact on the environment, a new environmental report is not planned for this effort.

7 ALARA Analysis

Since the site as a whole is not being released for unrestricted use in accordance with 10 CFR 20 subpart E, an ALARA analysis has not been performed in that context.
8 Planned Decommissioning Activities

The planned decommissioning activities for the fuel operation are relatively simple, use common processes and present little risk. Looking at the process relative to the regulatory requirements for submitting a decommissioning plan described in 10 CFR 70.38, the proposed procedures are consistent with the regulation and are planned to proceed prior to formal approval of this DP.

The decommissioning procedures do not increase the potential health and safety impacts to workers or to the public, such as in any of the following cases:

(i) Procedures would involve techniques not applied routinely during cleanup or maintenance operations;

(ii) Workers would be entering areas not normally occupied where surface contamination and radiation levels are significantly higher than routinely encountered during operation;

(iii) Procedures could result in significantly greater airborne concentrations of radioactive materials than are present during operation; or

(iv) Procedures could result in significantly greater releases of radioactive material to the environment than those associated with operation.

The movement, decontamination, surveying, packaging, shipping and disposal of radioactive material are all processes that are normally conducted at the plant as part of the routine operation and maintenance of the facility. The digging of soils, removal of underground pipes and excavations, although not frequent, are also performed occasionally as part of the normal plant operations and maintenance. Some of these projects included the wet weather stream excavation, the SERF 5 and Chemistry building excavations, the waste water pipe removals in 2009 and 1986, the SERF-1 decontamination, the pelletizing plant decommissioning and multiple facility modifications over the history of the site. Experience with these projects is consistent with the type of work activities that may ensue during the decommissioning.

8.1 Contaminated Structures

A limited area of the south end of the fuel plant is the only structure with residual SNM contamination. The remainder of the site has been used for handling by-product material, which will continue under the Commonwealth of Virginia license. As discussed in section 4.1 the south side of the fuel plant was used for handling unclad uranium as depicted in Figure 5. The pellet loading room will be decommissioned by the following:

- The equipment in the PLR will be removed and either decontaminated and free released or sent to a licensed facility for treatment, use or disposal
- Ventilation HEPA filters and pre-filters will be removed and disposed as LLRW
- Decontamination of floors and walls using mechanical systems
- Survey and document results
It is likely that this room will be used as a contamination control area for by-product material work under the Commonwealth of Virginia License.

8.2 Contaminated Systems and Equipment

The contaminated systems and equipment involving unclad uranium are relatively simple and consist of the ventilation system and the waste water line.

Ventilation System

The ventilation system for the pellet loading room consists of a recirculation loop that conditions the air and an extract loop that provides removal of air from the PLR. The system, which includes pre filters/HEPA filterbanks, will either be dismantled and sent off site for treatment, use or disposal at another licensed site or decontaminated and reserved for use with by-product material. If the system is left, the residual uranium will be quantified and used as part of the demonstration that SNM is less than 350 g $^{235}$U.

Waste Water Line

Preliminary measurements of the waste water piping system support the assumption that the system has little accumulation of uranium. Since the initial evaluation is based on a limited data set, additional measurements are planned to more fully characterize the residual uranium. Additionally, to support the characterization, at least two excavations are planned to gain access to the waste water line. The first excavation will remove the pipe from its current terminus to an area about 20 feet from the fuel plant.

Figure 11 Pipe Sampling Excavations

The second excavation will include the underground pipe around the outside of the met lab. By removing these sections, the remaining pipe will primarily be the inaccessible parts under the building foundation. In addition to the excavations, access to the piping system will be
gained from floor caps and vents. By using the sample results from multiple access points the residual activity and mass of uranium will be calculated for the system.

**Equipment**

The PLR equipment will be decontaminated and surveyed for release, shipped to other facilities for use or disposed as LLRW. Shipping will be in accordance with standard work practices and shipping program.

**8.3 Soil**

Soil samples are routinely collected as part of the environmental monitoring program and during special projects or construction activities. Based on the results of the routine environmental samples and special samples, there do not appear to be any soil areas that will require remediation.

**8.4 Surface and Groundwater**

Surface water is routinely sampled for radioactivity as part of the environmental monitoring program. Based on many years of sample analysis that demonstrate compliance with effluent limits, there is not a need to remediate surface waters. As discussed in section 4.6, groundwater sampling is planned.

![Figure 12 Ground Water Wells](image)

**8.5 Schedules**

The planned schedule below provides the major anticipated milestones or tasks associated with the decommissioning.

February 2011

- Complete fuel rod loading and bundle assembly
- Package and return uranium scrap to Richland
- Package and ship limited contaminated equipment to Richland
Package and ship for disposal surplus contaminated equipment
Start pellet loading room decontamination

March 2011
Ship final fuel assemblies
Final SNM Inventory (zero balance)
Enter Decommissioning and zero fee category

April – August 2011
Decontaminate pellet loading room and ship waste
Perform radiological surveys and document results
Demonstrate that residual uranium is less than 350g $^{235}\text{U}$

Fall 2011
NRC terminate license (September 30)

9 Project Management and Organization

9.1 Decommissioning Management Organization

The decommissioning management organization is essentially the same as described in section 2.1 of reference 3. Reference to manufacturing function in reference 3 is meant to include decommissioning activities.

The Regulatory Affairs Function, in addition to the responsibilities described in reference 3, is responsible for preparing radiological survey plans, performing radiologic surveys and documenting the results of these surveys.

9.2 Decommissioning Task Management

Decommissioning tasks are managed through the use of Procedures and/or Radiation Work Permits (RWPs). The control of RWPs is described in section 4.3 of reference 3.

9.3 Decommissioning Management Positions and Qualifications

Based on the relatively simple nature of the decommissioning there are no unique decommissioning management positions. Qualifications are described in section 2.1 of reference 4.

9.4 Training

Training will be performed as described in section 11.2 of reference 3.

9.5 Contractor Support

Contractors, if used, will follow the same programmatic requirements described in reference 3.
10 Radiation Safety and Health Program

10.1 Radiation Safety Controls and Monitoring for Workers

10.1.1 Workplace Air Sampling Program
The workplace air sampling program is described in section 4.6 of reference 3.

10.1.2 Respiratory Protection Program
The respiratory protection program is described in section 4.11 of reference 4.

10.1.3 Internal Exposure Determination
The internal exposure program is described in section 4.9 of reference 4.

10.1.4 External Exposure Determination
The external exposure program is described in section 4.8 of reference 4.

10.1.5 Summation of Internal and External Exposures
Internal and external dose are summed as described in section 4.10 of reference 4.

10.1.6 Contamination Control Program
The contamination control program is described in section 4.7 of reference 4.

10.1.7 Instrumentation Program
The instrumentation program is described in section 4.12 of reference 4.

10.2 Nuclear Criticality Safety
The nuclear criticality safety program shall be maintained as described in section 5 of reference 3.

10.3 Health Physics Audits and Record-Keeping Program
The audit and records keeping program are described in section 11 of reference 3.

11 Environmental Monitoring Program

11.1 Environmental ALARA Evaluation Program
The fuel plant discharges airborne effluents through a single monitored ventilation stack. There are no liquid effluents from the fuel plant. Annually the airborne effluent is evaluated with respect to the 10 mrem ALARA constraint and monitoring results demonstrate that the resulting dose from the effluent meets the constraint. Effluent from the decontamination will not increase during the project and will therefore be at a level consistent with the ALARA constraint.
11.2 **Effluent Monitoring Program**
Airborne effluent from the single stack is sampled and analyzed during operation. Air samples will be collected from airborne effluent streams while in operation and the activity and quantity of material released calculated.

11.3 **Effluent Control Program**
Airborne effluent is controlled by HEPA filtration systems.

12 **Radioactive Waste Management Program**

12.1 **Solid Radioactive Waste**
Solid radioactive waste will either be sent for direct disposal at a licensed facility or sent to a 3rd party processor. Waste shipments are a normal facet of operating business and do not represent a departure from normal programs and procedures.

12.2 **Liquid Radioactive Waste**
Liquid radioactive waste, if generated, will either be absorbed in a media suitable for LLRW disposal or the liquid fraction evaporated in the existing evaporator.

12.3 **Mixed Waste**
It is not anticipated that mixed waste will be generated primarily because hazardous waste is not typically present or generated in the uranium handling part of the facility. If generated, the material will be treated and or disposed according to applicable EPA and NRC requirements.

13 **Quality Assurance Program**
The scope and complexity of this project is relatively simple and since the residual contamination levels are planned to be consistent with the current license and by-product license, no special requirements above the current QA processes (management measures) are planned.

13.1 **Organization**
Organization is described in section 2 of reference 3.

13.2 **Quality Assurance Program**
The QA program (Management Measures) is described in section 11 of reference 3.

13.3 **Document Control**
Document control, “Records Management,” is described in section 11.2.g of reference 3.

13.4 **Control of Measuring and Test Equipment**
The control of radiation detection instruments is described in section 4.12 of reference 3.
13.5 Corrective Action
The corrective action (configuration management) program is described in section 11.2.a of reference 3.

13.6 Quality Assurance Records
Records are described in section 11.2.g of reference 3.

13.7 Audits and Surveillances
The audit and surveillance program is described in section 11.2.e of reference 3.

14 Facility Radiation Surveys

14.1 Release Criteria
As discussed in previous sections, the release criteria proposed are based on the condition that residual SNM meets the criteria of 10 CFR 150. For the radionuclides of concern in the fuel plant this is equivalent to 350 g U-235. Adjustment in this value if needed for Pu sources would use the sum of the fractions rule discussed in 10 CFR 150.

Control levels for surface contamination will be as discussed in reference 1 which is incorporated by reference into the SNM and by-product material licenses.

14.2 Characterization Surveys
Characterization surveys are planned for the waste water line to either guide further action or to demonstrate that any residual uranium is less than 350 g $^{235}$U. The piping system will be accessed in multiple locations and will include the north termination point, the met lab and multiple floor caps and ventilation risers. The pipe will be visually inspected in these locations and if sludge is present it will be sampled and analyzed for uranium. The interior surface of the pipe will be measured for gross alpha contamination. Results of these measurements will be used to infer the total uranium that may be contained in the piping system.

The PLR, as previously discussed, is contaminated above release guidelines and no additional characterization is needed since the levels present have little impact on the safety and methods that will be used to decontaminate the area.

Based on the post decontamination surveys of the former pellet plant/SERF-1, no additional characterization surveys are planned.

14.3 Remedial Action Support Surveys
Radiation surveys will be conducted to support remediation activities and to determine when a survey unit is ready for the final status survey. The survey program is documented in current procedures.
14.4 Final Status Survey (FSS) Design
Because the site and buildings used for SNM will continue to be used for radioactive material and the residual radioactive material remaining is based on easily quantifiable values and not based on models of projected dose, the final status survey is somewhat simplified. A survey plan will be prepared that includes the piping and PLR. The design will be adequate to demonstrate that the 350 g $^{235}$U limit is met and that residual surface radioactivity is consistent with the Commonwealth of Virginia License.

14.5 Final Status Survey Report
A final status survey report will be prepared that demonstrates that the decommissioning objectives have been met, i.e., the residual uranium in the piping system is less than 350g $^{235}$U and surface contamination in the PLR is consistent with the Commonwealth or Virginia License.

15 Financial Assurance
AREVA has provided financial assurance in the form of a standby letter of credit. The Letter of Credit currently covers the estimated decommissioning costs of the entire site including the activities licensed by the Commonwealth of Virginia.

The cost estimate was recently updated in November 2010 consistent with the requirements of 10 CFR 71.25 and reflects the current state of the facility. No updates are needed to reflect the proposed decommissioning.

As the decontamination proceeds the cost estimate and associated financial guarantee may be adjusted to reflect the remaining costs.