1.0 INTRODUCTION

The Westinghouse Electric Company, LLC (Westinghouse) Columbia Fuel Fabrication Facility (CFFF) fabricates low-enriched uranium fuel assemblies for commercial light-water nuclear reactors. The CFFF is located 13 km (8 mi) southeast of Columbia, South Carolina (SC) in Richland County. Facility buildings and related support areas occupy about 24 ha (60 ac) of a 469-ha (1158-ac) site. The facility has been in operation from 1969 to the present. The fabrication process involves the chemical conversion of uranium hexafluoride (UF_6) to uranium dioxide (UO_2) using the Ammonium Diuranate (ADU) Process. The UO_2 is formed into ceramic fuel pellets, which are used in the nuclear fuel assembly. The current production level at full capacity is about 1,500 metric-tons of uranium (MTU)/year by utilizing five ADU lines.

In accordance with Title 10, Code of Federal Regulations, Part 70 (10 CFR 70), Westinghouse possesses Special Nuclear Material (SNM) License 1107 (SNM-1107) from the U.S. Nuclear Regulatory Commission (NRC) to operate the CFFF. On September 28, 2007, the NRC approved a renewal of the license for a 20-year period. The purpose of this ER is to provide a resource document in support of future potential applications to the NRC for SNM License Amendments. This includes supporting an application for a 40-year license extension, as provided for in NRC Staff Requirements Memorandum SECY-06-0186 "Increasing Licensing Terms for Certain Fuel Cycle Facilities" dated September 26, 2006.

This ER has been prepared in accordance with NRC 10 CFR 51.60 and guidance contained in NUREG 1748 Chapter 6 (NRC, 2003). It reflects and updates information Westinghouse provided NRC in prior environmental documentation for the CFFF in 1975, 1983 and 2004; and in support of license renewal applications (Westinghouse, 1975, 1983 and 2004). In addition, the NRC considered the latter documentation in preparing an Environmental Impact Statement (EIS), an Environmental Assessment (EA) and similar documents for the CFFF (NRC, 1985, 1995 and 2007a). The previous reports have documented the Westinghouse CFFF environmental protocol and management program and have concluded that the environmental impact of operating the CFFF is minimal. NRC regulations 10 CFR 51.60 provide for incorporating previously submitted environmental information. Past NRC reviews of CFFF operations, undertaken in accordance with 10 CFR 51.7 requirements regarding the National Environmental Policy Act (NEPA) of 1969, identified no significant environmental impacts. The plant has been safety operated since September 1969, and no major events have occurred in the interim which would reverse those previous conclusions.

Major sections of the ER consist of the following:

- 1.0 Introduction
- 2.0 Facility Description
- 3.0 Description of the Affected Environment
- 4.0 Environmental Impacts
- 5.0 Mitigation Measures
- 6.0 Environmental Measurements and Monitoring Programs
- 7.0 Cost Benefit Analysis
- 8.0 Summary of Environmental Consequences
- 9.0 List of References
- 10.0 List of Preparers

The remainder of this section includes Section 1.1, Purpose and Need for the Proposed Action; Section 1.2, Proposed Action; and Section 1.3, Applicable Regulatory Requirements, Permits, and Required Consultations.

1.1 Purpose and Need

The global energy crisis supports a potential future growth in commercial nuclear power both within the United States (U.S.) and worldwide. Westinghouse supports the nuclear industry at CFFF by manufacturing low-enriched uranium fuel for light-water commercial nuclear reactors. The CFFF has a current full capacity of about 1,500 MTU/yr by utilizing five ADU lines. With consideration to future demand for additional uranium fuel within the U.S. and by other countries, Westinghouse believes that continued operation the CFFF is vital to meet this demand.

1.2 Proposed Action and Alternatives

Proposed Action
The proposed action is to grant CFFF a 40 Year License Renewal.

CFFF is also applying for an amendment to its existing license in order to increase the site's possession limit for ^{235}U. A granted Increase in CFFF's possession limit would enable the CFFF to expand the Uranium Hexafluoride (UF_6) Pad Annex, also known as the "auxiliary UF_6 storage pad." The license amendment and additional information submitted, which explain the project in more detail were submitted in November 2014 (Docket 70-1151 and TAC L33353) (Westinghoouse 2014l) .

A modification to the current calcium fluoride release limit has also been requested. Justification for such an increase is contained in calculation note CN-SB-12-018 (Westinghouse 2014k). The proposed limit would allow concentrations of 60 pico-curies per gram to replace the current value of the 30 pico-curies per gram limit as currently stated in SNM-1107 12.1.6.

No other proposed changes are anticipated in the foreseeable future; however if circumstances changed an amendment to the existing license would need to be submitted at that time.

No-Action Alternative
For the purpose of this ER, the No-Action Alternative is defined as a denial by NRC for the 40-year license request. The denial would result in continued CFFF operations in accordance with the existing license, which expires on September 30, 2027.

Aside from the Proposed Action, the No-Action Alternative is the only alternative considered in this ER. Besides the possession limit increase and calcium fluoride release limit increase, all future changes to the CFFF would become a Proposed Action, potentially requiring an updated ER.

1.3 Applicable Regulatory Requirements and Permits

Commercial nuclear fuel fabrication facilities in the United States must obtain licenses from the NRC to manufacture, produce, receive, acquire, own, possess, use, or transfer special nuclear material (10 CFR 70.3). Each license specifies the authorized special nuclear materials, their chemical and/or physical forms, and the maximum quantity of each material that the licensee is allowed to possess at any one time. License applications for facilities such as CFFF, and applications to modify facilities, require that the applicant provide an ER, which the NRC uses as a basis to prepare an Environmental Assessment (EA) regarding the planned future operations to be covered by the license application. The NRC provides guidance on format and content of ERs prepared by applicants and the EAs prepared by NRC in NUREG-1748 (NRC, 2003). Such facilities also require permits from the State that include a National Pollutant Discharge Elimination System (NPDES) permit for liquid discharges and an Air Permit for air pollutant discharges.

In accordance with 10 CFR 70, Westinghouse possesses Special Nuclear Material License 1107 (SNM-1107) for CFFF from the NRC. In addition, the facility has NPDES and Air Permits from the State of South Carolina Department of Health and Environmental Control (SC-DHEC). On September 29, 2005, Westinghouse submitted a request to the NRC for a license renewal for a 10 year period. This application included an ER prepared by Westinghouse dated December 2004, which NRC used in preparing an EA. Subsequently, Westinghouse modified the license renewal application for a 20-year period, which was approved by the NRC.

In September 2006 the NRC issued NRC Staff Requirements Memorandum SECY-06-0186, "Increasing Licensing Terms for Certain Fuel Cycle Facilities," in which the NRC approved recommendations to implement maximum license terms of 40 years for license renewals and new applications (NRC, 2006). The NRC also approved of license terms for less than 40 years on a case-by-case basis where there are concerns with safety risk to the facility or where a licensee introduces a new process or technology. Such potential license extensions are specific to licensees required to submit integrated safety analysis (ISA) summaries according to 10 CFR Part 70, Subpart H, requirements. Since the CFFF falls in the latter category, Westinghouse will submit a license renewal application for a license extension to a 40 year period as per the NRC guidance. The purpose of this report is to provide justification at a summary level for such a license extension.

A listing of all Federal, State of South Carolina, and local permits, licenses and certifications for the CFFF currently in effect is presented in Appendix A, Table A-1. Potential stakeholders having an interest in CFFF operations are listed in Appendix A, Tables A-2 and -3.

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2.0 SITE AND FACILITY DESCRIPTION

This section describes the CFFF in terms of the site and facility operations (Sections 2.1) and summarizes the environmental impacts and cumulative effects of past, present, or reasonably foreseeable future actions at the site (Section 2.2). The No-Action alternative consists of continued operation of the CFFF using the existing five-line ADU Process with a capacity of about 1,500 MTU/yr enriched to a maximum of 5 wt-% of ^{235}U for the remainder of the current license period which ends on September 30, 2027.

2.1 CFFF Description

This section describes the CFFF in terms of the site and location (Section 2.1.1), facility layout (Section 2.1.2), processes (Section 2.1.3) and the waste confinement and effluent control (Section 2.1.4).

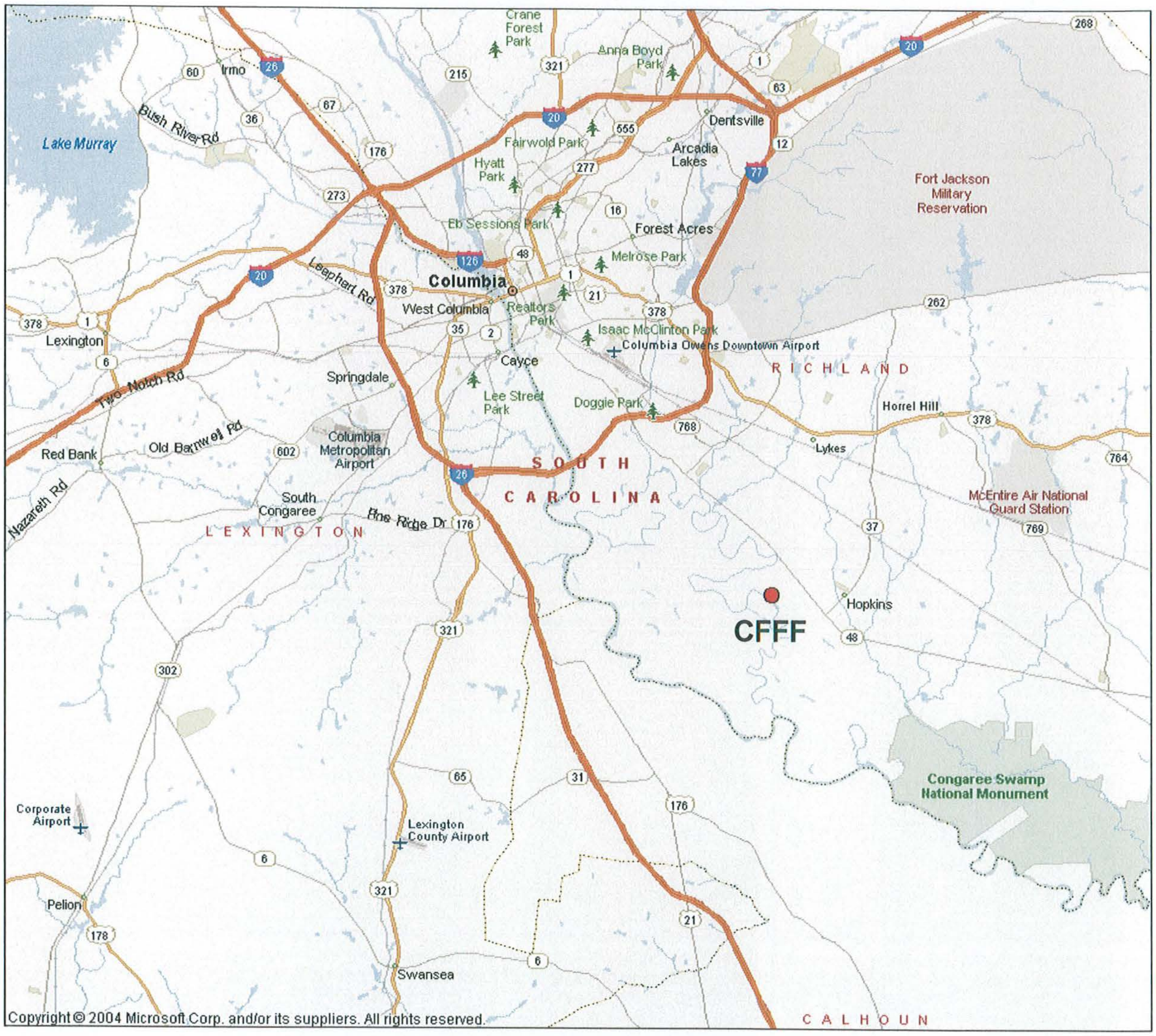
2.1.1 Facility Site Location and Description

The CFFF site is located in the central part of SC in Richland County, 13 km (8 mi) southeast of the city limits of Columbia along SC Highway 48 (see Figures 2.1-1 and 2.1-2) (Westinghouse, 2008b). The site coordinates are 33° 52' 52" north latitude and 80° 55' 24" west longitude. Figure 2.1-2 shows the area within a radius of 13 km (8 mi; approximately 7.5 minutes). The inner circle represents an 8 km (5-mi) radius around the plant, 90 percent of which falls in Richland County and the remaining 10 percent falls within Calhoun County, to the south. Figure 2.1-3 shows the topographical detail of the site and the surrounding area.

The CFFF is located on a semi-rural plot of approximately 469 ha (1,158 ac). The main manufacturing building, waste treatment areas and holding ponds, parking lots, and other miscellaneous buildings occupy approximately 5 percent (24 ha [60 ac]) of the site area. About 445 ha (1,098 ac) of the site remain undeveloped. The facility is at an elevation of approximately 43 m (142 ft) above mean sea level (MSL). Storm water drains from the site drain into Sunset Lake and Mill Creek, which in turn drains into the Congaree River, about 6.4 km (4 mi) distant. Figure 2.1-4 is an aerial photograph of the CFFF.

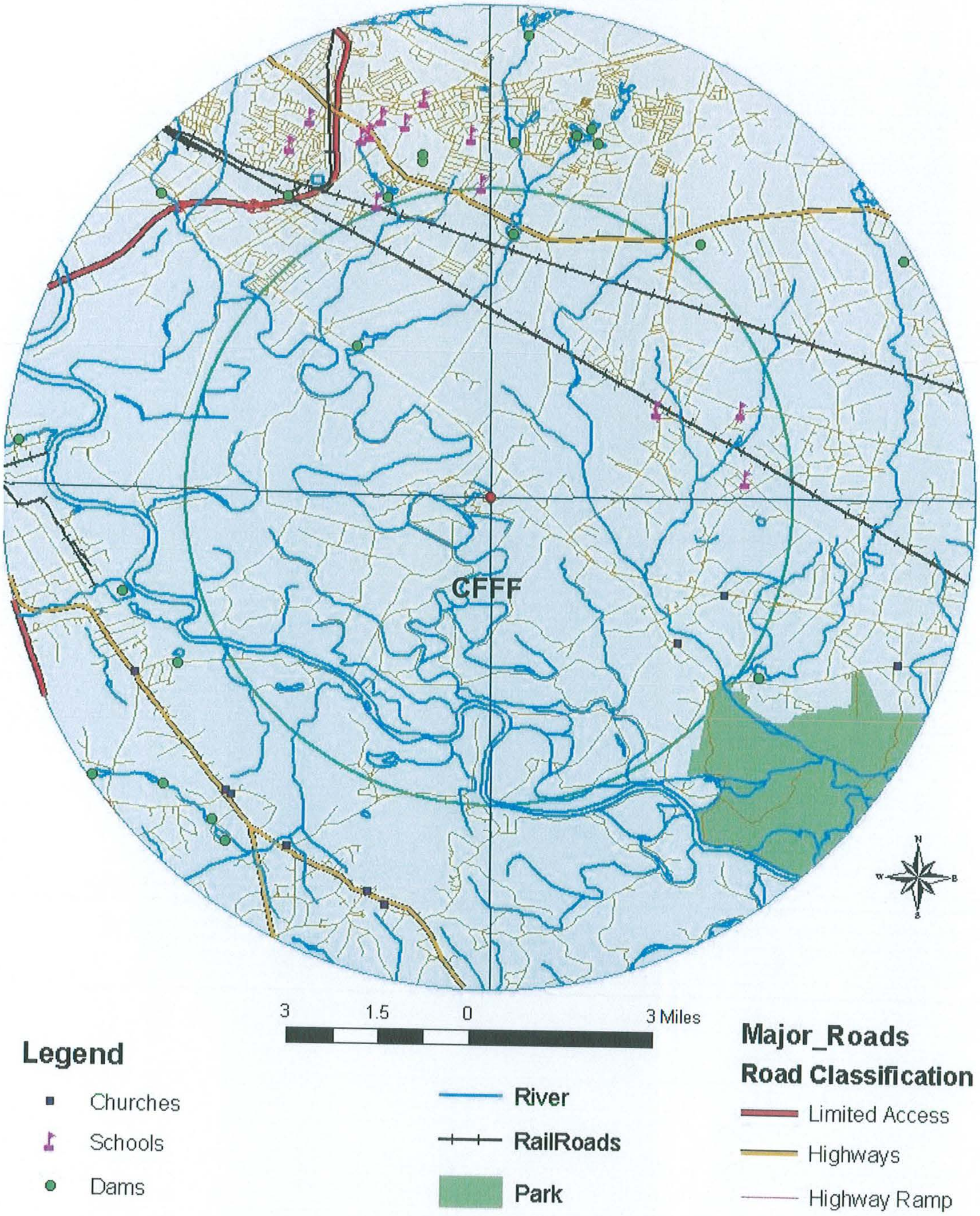
The CFFF site is bounded by SC 48 (Bluff Road) to the north and by private property owners to the east, south, and west. Figure 2.1-5 shows the CFFF site's property boundary. The "Controlled Area Boundary" is equivalent to the CFFF site's property boundary and encompasses the "Restricted Area." "Off-Site" areas are beyond the site's property boundary.

The manufacturing facilities are located about 490 m (1,600 ft) from the nearest point on the site boundary. The main manufacturing building for the CFFF is set back approximately 760 m (2,500 ft) from the roadway. The main plant road, which connects the CFFF to Bluff Road, provides access for vehicle and truck traffic. A continuously staffed security guard station is located on the main plant road. Access to the site is controlled by a number of security measures, including fencing, security barriers, and natural barriers (e.g., land contours). The "Restricted Area" is defined in the license as the area within the fenced area, including the main manufacturing building on the site. It is restricted in that individuals in this area must enter through security, and outsiders must be escorted. The "Restricted Area" is a physically defined area, bounded on three sides by a security fence and on the fourth side by the administration and main manufacturing building.



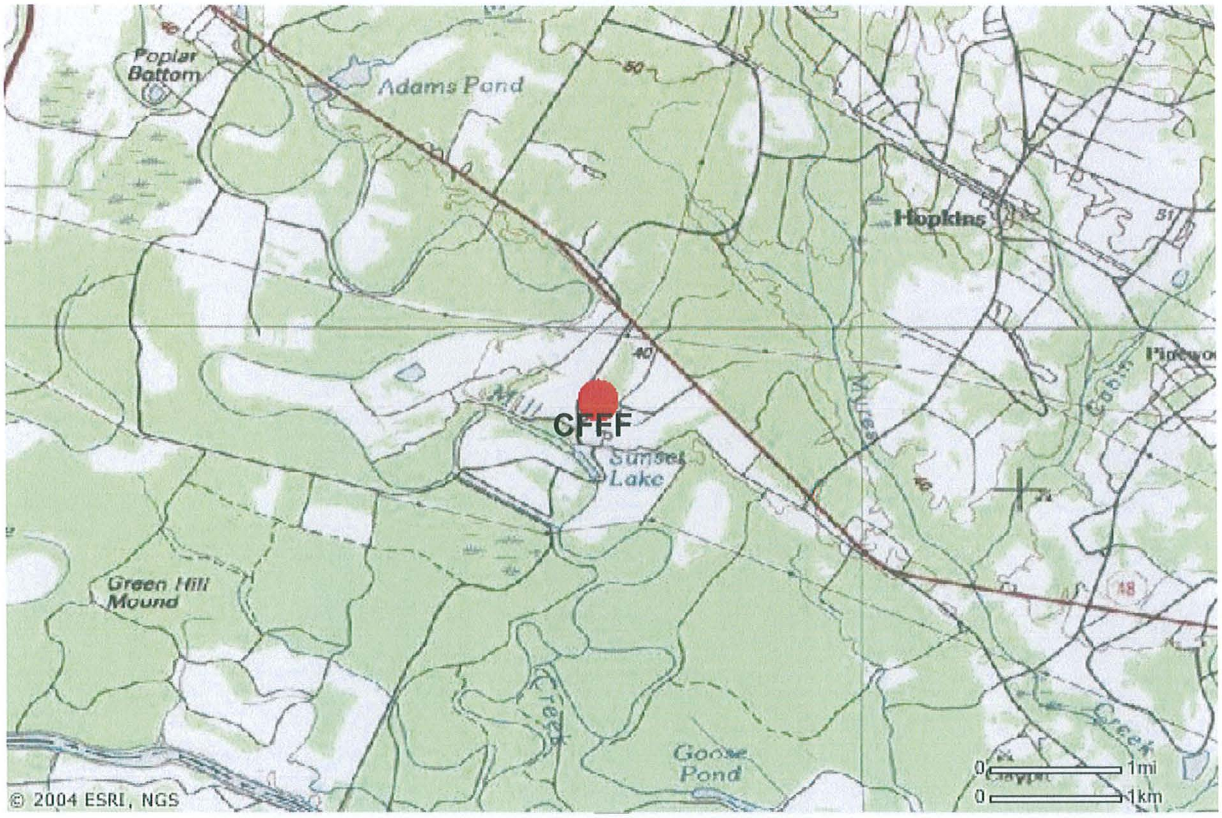
Source: Westinghouse, 2012a

Figure 2.1-1 CFFF and Surrounding Area



Source: Westinghouse, 2012a

Figure 2.1-2 Area Surrounding the CFFF Site within 5 Miles



Source: Westinghouse, 2012a

Figure 2.1-3 Topographical Detail of the CFFF Site and Surroundings

Source: Westinghouse, 2012a

Figure 2.1-4 Aerial Photograph of the CFFF

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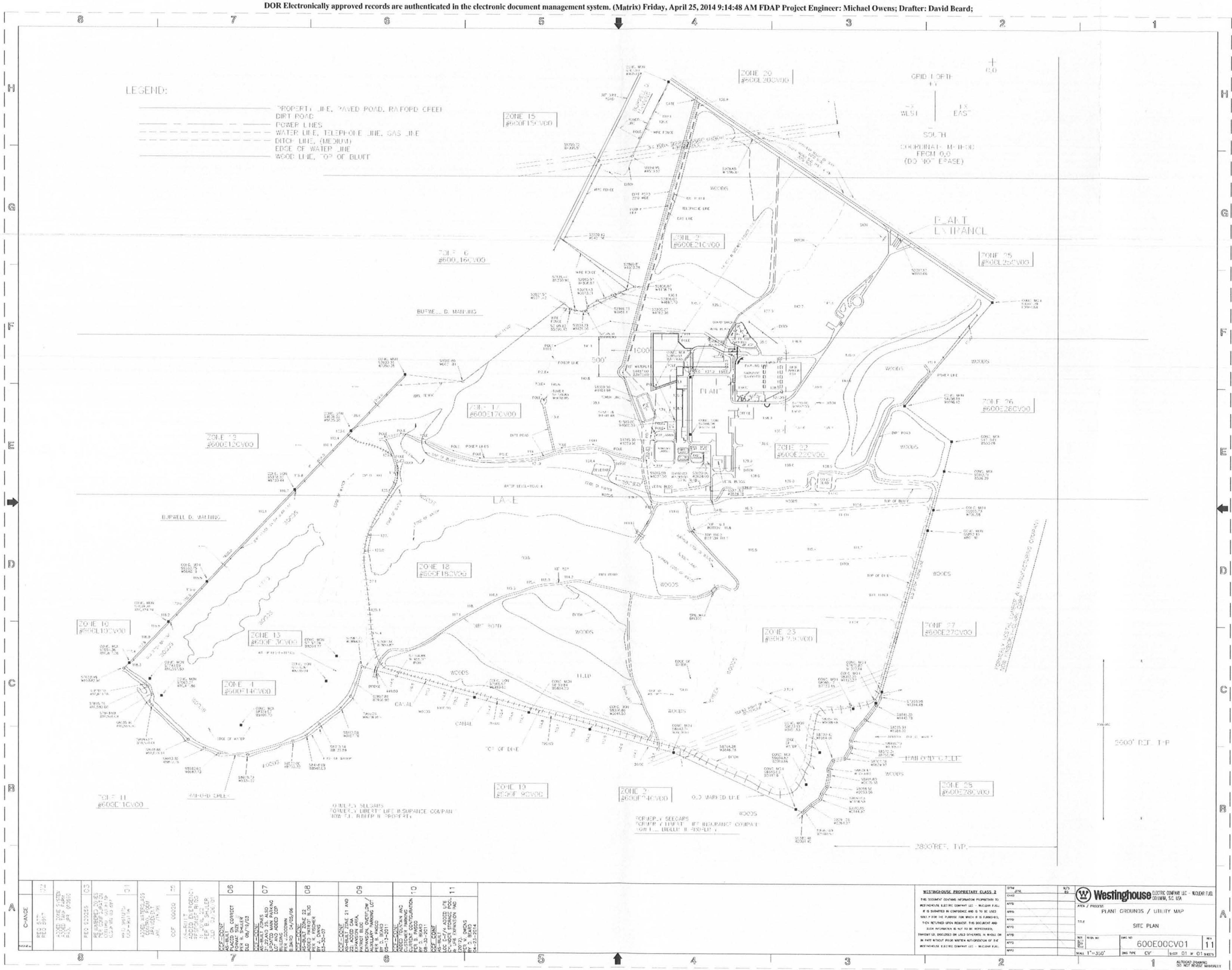

Figure 2.1-5 CFFF Boundary

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The Controlled Access Area (CAA) is routinely monitored and patrolled, and access to this area can be limited (see Figure 2.1-5). Westinghouse recently extended the CAA fence to allow better control of incoming and outgoing shipments of material related to CFFF operations (Westinghouse, 2009).

2.1.2 Facility Operations and Layout

The manufacturing operations consist of receiving low-enriched (less than or equal to 5.0 wt% ^{235}U) UF_6 in cylinders; converting the UF_6 to produce UO_2 powder; and processing the UO_2 powder through pellet pressing and sintering, fuel rod loading and sealing, and fuel assembly fabrication. These operations are supported by absorber addition, laboratory, scrap recovery, and waste disposal systems. Most of the manufacturing operations are conducted in the main manufacturing building, which can be divided into two areas: the Chemical Area and the Mechanical Area. Uranium operations conducted in the Chemical Area include UF_6 conversion, powder blending, pellet manufacturing, fuel rod loading, and scrap processing. Uranium operations conducted in the Mechanical Area involve only encapsulated and sealed material, such as rod certification and storage, and final assembly. All manufacturing operations are governed by approved radiation and environmental protection, nuclear criticality safety, industrial safety and health, SNM safeguards, and quality assurance controls.

The site layout is presented in Figure 2.1-6

2.1.3 Facility Processes

Two general systems have been used at CFFF to convert UF_6 to UO_2 powder: Integrated Dry Route (IDR) and the ADU processes. The IDR process within the main manufacturing building operated from approximately 1985 to 1995 with a capacity of approximately 400 MTU/yr. That portion of the facility, however, was inactivated in 1995 for business reasons.

<u>Ammonium Diuranate Process</u>

In the ADU process, UF_6 is received at a maximum enrichment of 5 wt-% ^{235}U in standard 30-B cylinders and shipping packages. As needed, a UF_6 cylinder is removed from the UF_6 cylinder storage area and connected to one of the conversion lines. The UF_6 is vaporized by heating the cylinder in one of the steam chambers located in the UF_6 vaporization area adjacent to the conversion lines within the Chemical Area.

The vaporized UF_6 is hydrolyzed to uranyl fluoride (UO_2F_2) by mixing with water. The UO_2F_2 is subsequently converted to an ADU slurry [$(NH_4)_2U_2O_7 + 4NH_4F + 3H_2O$] by adding ammonium hydroxide solution. The ADU slurry is dewatered, dried and then converted to the solid UO_2 product by heat and the introduction of hydrogen. The ammonia, fluorides, and steam in the calciner off-gases are scrubbed by a water scrubber and the gases are then passed through a high-efficiency particulate air (HEPA) filter assembly before discharge to the atmosphere. The dry UO_2 powder is conveyed from the calciner though a milling operation and into storage containers which are sampled, closed, and identified.

<u>Scrap Recovery</u>

Scrap recovery is accomplished by batch operations involving a variety of input materials. The preliminary operations concentrate the material and convert it to forms readily processed as U_3O_8 powder and uranyl nitrate (UN). Not all materials require processing through the entire sequence of operations. The basic processing sequence includes dissolution of solid forms in nitric acid, and the subsequent processing of the UN through the ADU process.

Off-gases from the UN dissolvers are routed through a reflux condenser, a scrubber to remove entrained particles and condensable vapors, and through HEPA filters prior to release. An incineration process is conducted to minimize the need for burial of low-level combustible contaminated waste and economically recycle product-grade material. A solvent extraction process recovers and purifies various contaminated uranium materials.

Pellet and Rod Manufacturing Processes

The product UO_2 powder from the chemical conversion area is then transformed into pellets after a series of operations that include feed preparation, pressing and sintering. To obtain precise dimensions, all pellets are processed through a grinding operation and are dimensionally checked. Following quality control approval, the pellets are loaded into empty fuel tubes, a spring is inserted into the plenum section, and end plugs are inserted and girth welded to the rod. Next the rod is pressurized with helium and seal welded.

Chemical Receipt, Storage and Handling

The CFFF uses a number of chemicals to support manufacturing operations. Chemicals and gases that are stored in bulk in tanks are (Westinghouse 2014c):

- Aqueous ammonia
- Argon
- Calcium hydroxide
- Calcium oxide
- Chlorine gas
- Fuel oil
- Gasoline
- Hydrofluoric acid
- Hydrogen
- Kerosene
- Nitric acid
- Nitrogen
- Oxygen
- Sodium hydroxide
- Sodium silicate
- Sulfur dioxide
- Sulfuric acid
- Triuranium octoxide (U_3O_8)
- Uranium dioxide (UO_2)
- Uranium hexafluoride (UF_6)
- Uranyl nitrate (UN)

Use of anhydrous ammonia at CFFF was eliminated in August 2011, and replaced by aqueous ammonium hydroxide (Westinghouse 2012a and e). A summary of the various hazardous chemicals used on-site is included in Appendix B, Table B-1.

Laboratories

Laboratories provide various services to support production operations and health and safety functions.

- Analytical Services Laboratory
- Chemical Process Development Laboratory
- Health Physics Laboratory
- Product Engineering Laboratory
- Metallurgical Laboratory
- ERBIA Analytical Laboratory.

<u>Shipping and Transportation</u>

All shipments of nuclear materials and wastes are carried out in conformance with NRC, U.S. Department of Transportation (DOT), and State of South Carolina requirements. Completed fuel assemblies are shipped to utility customers in approved containers licensed by the NRC. Low level waste shipments are appropriately packaged and analyzed for uranium content prior to shipment to licensed low-level waste burial grounds.

A summary of the shipments of nuclear materials, chemicals and solid waste (hazardous and non-hazardous) in support of CFFF operations is presented in Appendix B, Table B-2.

<u>Environmental, Health and Safety Systems</u>

Inherent in CFFF operations are the design provisions and administrative procedures to ensure 1) worker occupational safety; 2) public health and environmental protection; and 3) nuclear safety, including criticality safety.

2.1.4 Waste Confinement and Effluent Control

The CFFF operations generate gaseous and particulate emissions and liquid and solid wastes. All waste streams are controlled and treated prior to their release to the environment. The following sections describe the types of effluents from CFFF and methods for their control. The monitoring of effluent streams and the environment is addressed in Section 6.0.

<u>Airborne Effluents</u>

Forty-seven (47) exhaust stacks (Westinghouse 2014d) currently discharge airborne emissions from the main plant facility. The emissions consist primarily of uranium, ammonia (NH_3), and fluorides (NH_4F and HF). The composition of the uranium mixture will vary depending upon the enrichment of the material being processed; however, in all cases, the bulk of the material will be ^{238}U (95 wt-%), whereas the predominant activity will be ^{234}U (up to 86 percent of the total activity). All release points are either short stacks or roof vents, rather than elevated stacks. Airborne effluents are normally treated by HEPA filters, scrubbers, or both prior to release through stacks in accordance with 40 CFR 50 and 61, and 10 CFR 20.

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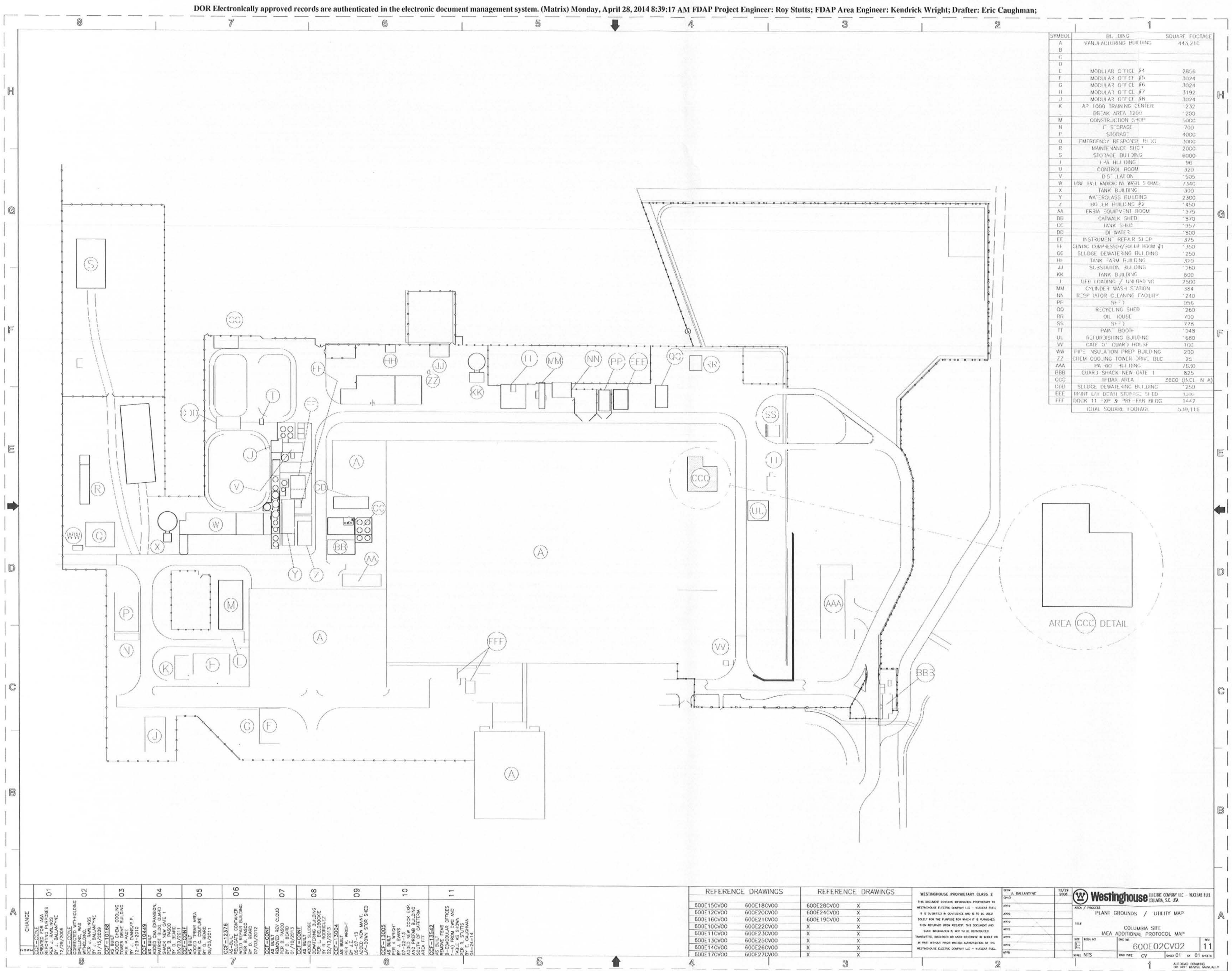

Figure 2.1-6 CFFF Site Plan

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