# ENCLOSURE 5

# SNM-1107 LICENSE RENEWAL APPLICATION

# WESTINGHOUSE ELECTRIC COMPANY LLC

# APPLICATION FOR RENEWAL
# OF A
# SPECIAL NUCLEAR MATERIAL LICENSE
# FOR THE
# COLUMBIA FUEL FABRICATION FACILITY
# HOPKINS, SOUTH CAROLINA

## LICENSE NUMBER
## SNM-1107

**March 28, 2019**
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## U.S. NUCLEAR REGULATORY COMMISSION
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# CHAPTER 1.0

# GENERAL INFORMATION

## 1.1 GENERAL INFORMATION STRUCTURE

### 1.1.1 Site Description

The Westinghouse Columbia Fuel Fabrication Facility (CFFF) is located near Columbia, South Carolina, and is situated on a 1,151 (approximate) acre site in Richland County, some 8 miles southeast of the Columbia city limits, along State Highway 48 (Bluff Road). The area around the site is sparsely settled, and the land is characterized by timbered tracts and swampy areas penetrated by unimproved roads. Farms, single-family dwellings, and light commercial facilities are located along nearby highways.

Of the total acreage, approximately 68 acres have been or are being developed to accommodate the fuel fabrication buildings, holding ponds, parking and landscaped areas. Approximately 1,083 acres of the site remain undeveloped. Maps of the property boundary and the site plan are maintained at the site.

More details of the CFFF location, including proximity to nearby towns, industries, public facilities, the Congaree River, transportation links, and site topography are presented in the *CFFF Site and Structures Integrated Safety Analysis Summary*, prepared in accordance with the requirements in Chapter 4.0 of this License Application. Extensive details of the site characterization are presented in the *Environmental Evaluation Report* described in Chapter 10.0 of this License Application and in subsequent updates.

### 1.1.2 Facility and Process Description

The CFFF manufactures fuel assemblies and components for commercial nuclear power plants. The manufacturing operations to be authorized by this License Application consist primarily of receiving low-enriched, less than or equal to 5.0 weight percent (w/o) U-235, uranium hexafluoride ($UF_6$); converting the $UF_6$ to produce uranium dioxide ($UO_2$) powder through the Ammonium Diuranate (ADU) conversion process; and, processing the $UO_2$ powder through pellet pressing and sintering. These processes are followed by fuel rod loading and sealing, fuel assembly fabrication and shipping. Manufacturing operations are governed by technically sound safety programs (i.e., radiation safety, nuclear criticality safety (NCS), chemical safety, fire safety, industrial safety and health, emergency management, environmental protection and integrated safety), Special Nuclear Material (SNM) safeguards, and management measures described in detail in this License Application.

The CFFF manufacturing operations are supported by neutron absorber addition or coating, laboratory analysis, scrap recovery, and waste disposal systems. Detailed facility and process descriptions are provided in the *CFFF Integrated Safety Analysis Summary*, prepared in accordance with the requirements in Chapter 4.0 of this License Application.

### 1.1.2.1 Site Utilities and Services

(a) Electrical Supply

The CFFF is served by a single 115,000 volt electrical supply line. Diesel-powered standby generators are available and maintained to meet site back-up electrical power requirements in the event of a temporary outage of the normal supply source. The back-up power is automatically provided to the criticality accident alarm system; emergency lighting systems; fire alarm system; health physics sampling systems; and other designated systems.

(b) Water Supply

A 10-inch main from the Columbia Municipal Water Authority supplies water to the site.

(c) Gaseous and Liquid Effluent Management

Gaseous exhausts from process areas with potential for contamination are passed through HEPA filtration to remove entrained uranium particulates prior to discharge to the environment. Exhausts containing uranium in soluble form are passed through aqueous scrubbers preceding the High Efficiency Particulate Air (HEPA) filters. Following filtration, sampling of this exhaust is performed in compliance with regulations.

Liquid process wastes are treated prior to discharge to the Congaree River. Waste treatment for removal of uranium, ammonia and fluorides, consists of filtration, flocculation, lime addition, distillation and settling (in a series of holding lagoons). Site sanitary sewage is treated in an extended aeration package plant prior to discharge, either directly or through a polishing lagoon. The discharged effluent is chlorinated and mixed with treated liquid process waste at the facility lift station. The combined waste is then passed through a final aerator, followed by pH adjustment as necessary and subsequently pumped to the river via a 4-inch pipeline. Compliance with licensed discharge limits is verified by passing the waste streams through on-line monitoring systems; or, by manual sampling and analysis on a batch-basis. The treatment systems are designed with sufficient holdup capacity to assure that the discharge limits are continuously met.

Storm water from the site enters a system of drainage ditches and ultimately flows to the Congaree River.

(d) Solid Waste Storage and Disposal

Solid wastes are sorted into appropriate combustible and noncombustible categories and are placed in specifically designated collection containers located throughout the work areas. The wastes consist of paper, wood, plastic, metal, floor sweepings, and similar materials which depending on source location, may be

contaminated by, or contain uranium. Following a determination that the wastes are properly sorted, the contents are processed, recycled or disposed of in accordance with plant procedures.

Materials that are suited for complete survey may be decontaminated for free-release, or re-use, in accordance with provisions of this License Application. Combustible materials are packaged in compatible containers, assayed for grams U-235, and stored to await incineration. Noncombustible wastes and selected combustible wastes are packaged in compatible containers, compacted when appropriate, measured to verify the uranium content, and placed in storage to await shipment for further treatment, recovery or disposal.

Administrative controls assure that only authorized materials are packaged for disposal. These include verification of package contents, container security to minimize the probability of unauthorized additions to the containers, and documentation of package contents.

(e) Site Safeguards

Physical Security at the CFFF is described in the NRC-approved *Physical Security Plan for the Columbia Fuel Fabrication Facility*, and Nuclear Material Control and Accounting (MC&A) is described in the NRC-approved *Fundamental Nuclear Material Control Plan for the Columbia Fuel Fabrication Facility*. Both plans are maintained current in accordance with applicable regulations. These plans detail the measures employed at the facility to detect potential loss of, and mitigate the opportunity for theft of, SNM of Low Strategic Significance, in accordance with the applicable requirements of 10CFR73 and 10CFR74 as well as controls for Depleted and Natural Uranium in accordance with the applicable requirements of 10CFR40.

(f) Defense-in-Depth Design for Licensed Material

For new CFFF facilities, or new processes at existing facilities, the defense-in-depth design philosophy is implemented. For existing facilities, the defense-in-depth design philosophy is implemented where practicable. An example of this philosophy follows:

(1) Dispersible hazardous material work is conducted in hoods, glove boxes, or other enclosures;
(2) The hoods, glove boxes, and other enclosures are located within a Contamination Control Area;
(3) The Contamination Control Area is located within the manufacturing building;
(4) The manufacturing building is serviced by a HEPA filtered ventilation system;
(5) The ventilation system exhaust stacks are located within the Controlled Access Area (CAA); and
(6) The CAA is located within the CFFF Site Boundary.

(g) Instrumentation and Control Systems for Licensed Material

For new CFFF facilities, or new processes at existing facilities, a design philosophy that includes instrumentation and control systems to monitor and control the behavior of active engineered Items Relied on for Safety (IROFS) is implemented. For existing facilities, a design philosophy that includes instrumentation and control systems to monitor and control the behavior of IROFS is implemented where practicable. This philosophy may take the form of a Safety Instrumented System (SIS). An example of a SIS would be a logic solver with a connected level probe as the sensor, and a connected solenoid valve as the final element; such that, when the process liquid level reaches the level probe, the logic solver shuts off the fluid input via the solenoid valve.

### 1.1.3 Scope of Licensed Activities

#### 1.1.3.1 Authorized Activities

Authorized activities at the CFFF include:

(1) Receipt, handling, and storage of Natural Uranium, Depleted Uranium and SNM as $UF_6$, uranium nitrates, uranium oxides; and/or contained in pellets, fuel rods, fuel assemblies, samples, scrap, and wastes;
(2) Receipt, handling, and storage of other licensed radioactive material;
(3) Chemical conversion processing including vaporization and hydrolysis, precipitation and centrifugation, drying, calcining, comminution, and blending;
(4) Fuel fabrication including powder preparation, die-lubricant addition, nuclear absorber addition, pelleting, sintering, grinding, pellet coating with nuclear absorbers, fuel rod loading and inspection, and final fuel assembly;
(5) Quality assurance and control activities;
(6) Analytical Services Laboratory operations including wet-chemistry and spectrographic methods;
(7) Metallurgical Laboratory operations including sample preparation, polishing, testing, and examination;
(8) Chemical Process Development operations including laboratory-scale process research, prototype development, and equipment check-out;
(9) Mechanical Process Development operations including laboratory-scale research and development;
(10) Health Physics Laboratory operations including sample preparation and analysis, instrument repair and calibration, respirator fit-testing, bioassay sampling and sealed source testing and storage;
(11) In-house and outsourced scrap recovery operations including scrap batch processing, solvent extraction, coated-pellet recovery, ash processing, scrap blending, and acid recovery;
(12) $UF_6$ cylinder washing and decontamination, hydrostatic testing, and recertification; and, re-work of returned fuel assemblies;
(13) Equipment and facility maintenance activities;
(14) Facility, equipment, and protective clothing decontamination activities;
(15) Waste storage and disposal preparation operations including HEPA filter testing, conversion liquid waste treatment, advanced waste-water treatment, lagoon storage, incineration, contaminated waste packaging for disposal, and calcium fluoride disposition;
(16) Ancillary mechanical operations including non-radioactive component fabrication and assembly; and
(17) Shipping package and over pack refurbishment and storage.

The CFFF may also perform work for other Westinghouse operations, or outside customers, which is within the authorized capabilities of the facility.

### 1.1.4 Material Possession Limits and Constraints

The following are the maximum quantities of nuclear materials that are possessed by the CFFF at any one time; and, the constraints on procurement, use, and transfer of such material.

(a) Material Possession Limits are: [redacted]

(b) [redacted]

(c) [redacted]

(d) [redacted]

(e) Constraints on procurement, use, and transfer of nuclear materials are: (1) Procurement quantities are in accordance with continuing CFFF manufacturing needs; (2) Production, utilization, and/or significant loss is not authorized; and (3) Transfer is only as arranged with facilities authorized to receive and possess the materials.

### 1.1.5 Institutional Information

This Application requests a forty-year renewal of License SNM-1107, Docket 70-1151, for the CFFF, located at 5801 Bluff Road in Hopkins, South Carolina, and operated by Westinghouse Electric Company LLC (Westinghouse). Westinghouse is indirectly owned and controlled by Brookfield WEC Holdings Inc., a Delaware limited liability company ("WEC Holdings"). Through an intermediate investment structure, WEC Holdings is, in turn, indirectly owned and controlled by Brookfield Asset Management Inc., a publicly-traded Canadian corporation. In accordance with the requirements of 10CFR70.22(a)(1), additional institutional information is provided as follows:

#### 1.1.5.1 Applicant and State of Incorporation

Westinghouse Electric Company LLC; Delaware

#### 1.1.5.2 Location of Principal Office

Cranberry Township, Pennsylvania

#### 1.1.5.3 Names (Citizenships) and Addresses of Principal Officers

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Executive Vice President, Global Operations Services
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Westinghouse Electric Company LLC
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Hopkins, SC 29061-9121

### 1.1.5.4 Company Contact for Licensing Matters

Douglas W. Weaver (USA)
Vice President**,** Global Nuclear Regulatory Affairs
Westinghouse Electric Company LLC
11333 Woodglen Drive, Suite 202
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### 1.1.5.5 Site Contact for Licensing Matters

Nancy Blair Parr (USA)
Manager, Licensing
Westinghouse Electric Company LLC
Westinghouse Columbia Site
5801 Bluff Road
Hopkins, SC 29061-9121

### 1.1.5.6 Additional Financial and Business Information

Additional financial and business information for Westinghouse was provided to NRC per LTR-RAC-18-01, dated January 5, 2018. More recently, Westinghouse provided additional financial and business information in its Application for Consent to Indirect Change of Control with Respect to Materials Licenses and Export Licenses and Notification Regarding Quality Assurance Program Approvals, Certificates of Compliance, and Design Certification, dated March 21, 2018 (ML18120A051) (License Transfer Application). The NRC approved the License Transfer Application on June 28, 2018 (ML18162A114), and the sale of Westinghouse closed on August 1, 2018.

## 1.1.6 Key Terms and Definitions

Throughout this License Application, the following terms are defined as indicated:

### 1.1.6.1 Anticipated Process Upset

An event that is expected to occur occasionally during the plant lifetime. For the NCS discipline, anticipated process upsets are considered as normal case conditions.

### 1.1.6.2 Byproduct Material

Byproduct material is defined in 10CFR30.4 Definitions.

### 1.1.6.3 Chemical Area

An area where uncontained radioactive material is processed, the probability of contamination on floors and accessible surfaces is high, and protective clothing is required. Examples include the $UF_6$ Bay, the Conversion Area, the Pelleting Area, and the Rod Loading Area.

### 1.1.6.4 Clean Area

An area where radioactive material, if present, is completely contained; and, there is negligible contamination on floors and accessible surfaces. Examples include the Machining Area, Rod Storage Area, Grid Assembly Area, Final Assembly Area, and the Office Areas.

### 1.1.6.5 Component

When used in an administrative context, this is an independent organizational unit that is distinguishable by its assigned responsibilities. Examples include the Engineering Component, the Manufacturing Component, the Quality Component, and the Regulatory Component.

### 1.1.6.6 Conduct of Operations

An alternate name for Management Measures, as defined in 10CFR70.4.

### 1.1.6.7 Contamination Control Area

An alternate name for the Chemical Area.

### 1.1.6.8 Contingency

A possible, but unlikely, change in a condition/control important to the NCS of a fissile material operation that would, if it were to occur, reduce the number of barriers (either administrative or physical) that are intended to prevent a nuclear criticality accident.

### 1.1.6.9 Controlled Area

The Controlled Area is equivalent to the CFFF site's property boundary. The Controlled Area is controlled in that it is routinely monitored and patrolled and access to this area can be limited by the licensee for any reason.

### 1.1.6.10 Controlled Access Area (CAA)

The CAA is another term equivalent to the "Restricted Area."

### 1.1.6.11 Credible

An event is described as "credible" if it does not satisfy the definition of "incredible" as defined in Section 1.1.6.20 of this License Application.

### 1.1.6.12 Credible Abnormal Configuration

An unlikely process upset that results in the loss of a contingency, and meets criteria specified in Section 6.1.4.2(6) of this License Application.

### 1.1.6.13 Defense in Depth

A design philosophy that is based on providing successive levels of protection such that health and safety is not be wholly dependent upon any single element of the design, construction, maintenance, or operation of the facility. Defense in Depth Controls increase the margin of health, safety, and protection of the environment.

### 1.1.6.14 Enrichment Limit

An authorized maximum enrichment barrier for a given material type that assures with at least 95% confidence that a given batch added to the CFFF process does not exceed 5.0 w/o U-235. This enrichment limit is calculated using the applicable sampling and analytical uncertainties for the enrichment determination of any material type received for the purpose of processing.

### 1.1.6.15 Equivalent Experience

When used in a personnel qualification context for equating experience with education, eight-years of applicable experience is equivalent to a baccalaureate degree.

### 1.1.6.16 Fixed Location General Air Sample

Air samples used to assess general area radioactivity concentrations; and, to assess the adequacy of radioactive material confinement and containment within the processing areas of the facility; and, to establish airborne radioactivity areas.

### 1.1.6.17 Fixed Location Breathing Zone Representative Air Sample

Air samples used to assess and assign operator intakes of airborne radioactive materials.

### 1.1.6.18 Frequencies

When audit, measurement, surveillance, and/or other frequencies are specified in license documents (such as this License Application, the Physical Security Plan, the Fundamental Nuclear Material Control Plan, *etc.*), the following time spans apply:

(a) *Daily* means once each 24-hour period;
(b) *Weekly* means once each 7-consecutive-days;
(c) *Monthly* means a period which covers a span of 40-days or less;
(d) *Quarterly* means a period which covers a span of 115-days or less;
(e) *Semiannual* means a period which covers a span of 225-days or less;
(f) *Annual* means a period which covers a span of 15-months or less;
(g) *Biennial* means a period which covers a span of 30-months or less; and,
(h) *Triennial* means a period which covers a span of 45-months or less.
(i) For unspecified time periods, an extension of 0.25 times the period will apply.

### 1.1.6.19 Function

An individual (or individuals), designated by the Component Manager, acting in coordination with the other personnel of the component, having the capability, responsibility, and authority to make and implement decisions required to carry out assigned duties. Examples for the Regulatory Component include the Environmental Protection Function, the Radiation Safety Function, the NCS Function, the Safeguards Function, *etc*.

### 1.1.6.20 Incredible

Any one of the following three independent acceptable sets of qualities could define an event as not credible, and therefore do not have to be considered in the Integrated Safety Analysis (ISA) as defined in 10CFR70.4:

- An external event for which the frequency of occurrence can conservatively be estimated as less than once in a million years.
- A process deviation that consists of a sequence of many unlikely upsets, including human actions or errors for which there is no reason or motive. (In determining that there is no reason for such actions, a wide range of possible motives, short of intent to cause harm, must be considered. Necessarily, no such sequence of events can ever have actually happened in any fuel cycle facility).
- Process deviations for which there is a convincing argument, given physical laws, that they are not possible, or are unquestionably extremely unlikely. (The validity of the argument must not depend on any feature of the design or materials controlled by the facility's system of Safety Significant Controls (SSC) or management measures).

Incredible scenarios may contain administrative SSCs. The ISA will classify these controls as SSCs unless the controls are also designated as IROFS in credible scenarios.

### 1.1.6.21 Licensed Activity

The combination of personnel, plant, and equipment established by Westinghouse to carry out the processing of radioactive material at the CFFF, as authorized by this License Application.

### 1.1.6.22 May

Denotes implied permission by NRC Licensing Staff to take a stated action or course.

### 1.1.6.23 Portable Air Sample

An air sample that is not integrated into the CFFF's central air sample vacuum system.

### 1.1.6.24 Process Upset

An event involving a deviation in a controlled process parameter or a condition outside of the normal operating range.

### 1.1.6.25 Radiation Worker

Any individual who, in the course of employment, is likely to receive an annual occupational dose in excess of 100-millirem (mrem).

### 1.1.6.26 Regulatory-Significant Procedures

Those procedures that contain, in whole or in part, actions that are important to safety (i.e., radiation safety, NCS, chemical safety, fire safety, industrial safety and health, emergency management, environmental protection and integrated safety) and/or safeguards.

### 1.1.6.27 Restricted Area

The "Restricted Area" is a physically defined area, represented on three sides by a minimum seven-foot high barrier fence topped by barbed wire and represented on the fourth side by the Administration Building and Main Manufacturing Building. This area is the **"**Controlled Access Area**"** described in the CFFF Physical Security Plan.

### 1.1.6.28 Special Nuclear Material (SNM)

SNM is defined in 10CFR70.4 Definitions.

### 1.1.6.29 Source Material

Source Material is defined in 10CFR40.4 Definitions.

### 1.1.6.30 Unlikely Event

An event is described as "unlikely" if its frequency of occurrence is sufficiently low to exclude it from normal case conditions.

### 1.1.6.31 Unrestricted Area

An Area to which access is neither limited nor controlled by the Security Function.

### 1.1.6.32 Will

Denotes a mandatory commitment to take a stated course or action.

# CHAPTER 2.0

# MANAGEMENT ORGANIZATION

## 2.1 MANAGEMENT ORGANIZATION STRUCTURE

Westinghouse Electric Company LLC (Westinghouse) is indirectly owned and controlled by Brookfield WEC Holdings Inc., a Delaware limited liability company. Through an intermediate investment structure, WEC Holdings is, in turn, indirectly owned and controlled by Brookfield Asset Management Inc., a publicly-traded Canadian corporation. Westinghouse is maintained as an independent business entity headquartered in the United States, with its own Board of Directors

### 2.1.1 Organizational Responsibilities and Authorities

Westinghouse is comprised of several product lines. One of these, Nuclear Fuel, is responsible for the design and manufacturing of nuclear fuel and components for commercial nuclear reactors worldwide. The Senior Vice President of Nuclear Fuel reports to the Executive Vice President of Global Operations Services, who reports to the President and Chief Executive Officer.

#### 2.1.1.1 Organizational Operating Units

Within Nuclear Fuel, the primary responsibility for U.S. domestic fuel fabrication activities rests with the Vice President of Columbia Fuel Operations. The Vice President of Columbia Fuel Operations reports to the Senior Vice President of Nuclear Fuel. The Vice President of Columbia Fuel Operations is the CFFF Plant Manager. Copies of detailed organization charts are available at the site.

#### 2.1.1.2 Positions and Activities within Organizational Operating Units

Westinghouse management positions are covered by a written description, presenting the scope, duties, responsibilities and authorities for the position. Position descriptions are specified in accordance with documented and approved practices. These practices assure that key functions are covered, inter-relationships are clear, and conflicts are eliminated. Persons are selected to fill these management positions by evaluating their capability to perform the various activities specified in the position description. The performance of managers in areas important to safety and security is assured through a formal program of annual reviews.

Operations at the CFFF are in accordance with Westinghouse procedures. Responsibility for all phases of operations, including safety, safeguards, and quality, follows the structured lines of organizational authority. Advisory and service groups are provided to assist line management in the evaluation of operations within their control; and, to provide measurements, determinations, and other information which aid in the analysis of specific operations and situations. However, such advice and service assistance in no way relieves

an individual line manager from accountability for operation of the function and facility or for ascertaining and assuring, through appropriate management channels, that adequate advice and service are being provided. Basic policies and procedures are established by line management with the review and approval of cognizant staff groups. Within the framework of these policies and procedures, the responsibility for making decisions at the operating level rests with the first level manager. A first level manager has the basic responsibility for operating licensed activities in a safe and compliant manner.

First level managers are responsible for assuring that activities are conducted in accordance with operating instructions and for the guidance and direction of subordinate personnel. Written procedures are prepared, which become the basis for performing specific operations. The first level manager cannot make unilateral changes in these procedures without review and approval by cognizant staff groups. First level managers are also responsible for assuring that personnel under their jurisdiction receive adequate training.

The Regulatory Component reviews and approves the orientation presentations for new employees. Fundamental radiation safety rules and policies, use of protective clothing and personnel monitoring devices, prevention of internal exposure, limiting external radiation exposure, NCS, and CFFF emergency procedures are among the topics covered. To acquaint a new employee with basic regulations, selected parts of Title 10, *Code of Federal Regulations*, are discussed. The cognizant first level manager assigns an experienced employee the responsibility for indoctrinating and training a new employee in the proper procedures and precautions for performing each specific job task. The first level manager then evaluates the progress of the new employee and gradually increases job assignments until complete requirements of the subject job description are fulfilled. Failure to achieve minimum performance requirements is cause for a change in assignment, or for release from employment. Periodic refresher training is conducted in accordance with applicable regulations and Westinghouse policies and procedures. As the need arises, changes in regulations, changes in operating conditions and/or practices, and changes in administrative policies are also covered.

To assure that employees, who are not members of the emergency response organization, are aware of actions to take during an emergency situation, annual training is provided. To keep emergency response personnel aware of the actions they must take during an emergency situation, emergency drills and exercises are conducted in alternate years. After each drill or exercise, appropriate plant personnel are informed of any shortcomings disclosed and subsequently instruct their personnel regarding any remedial actions required.

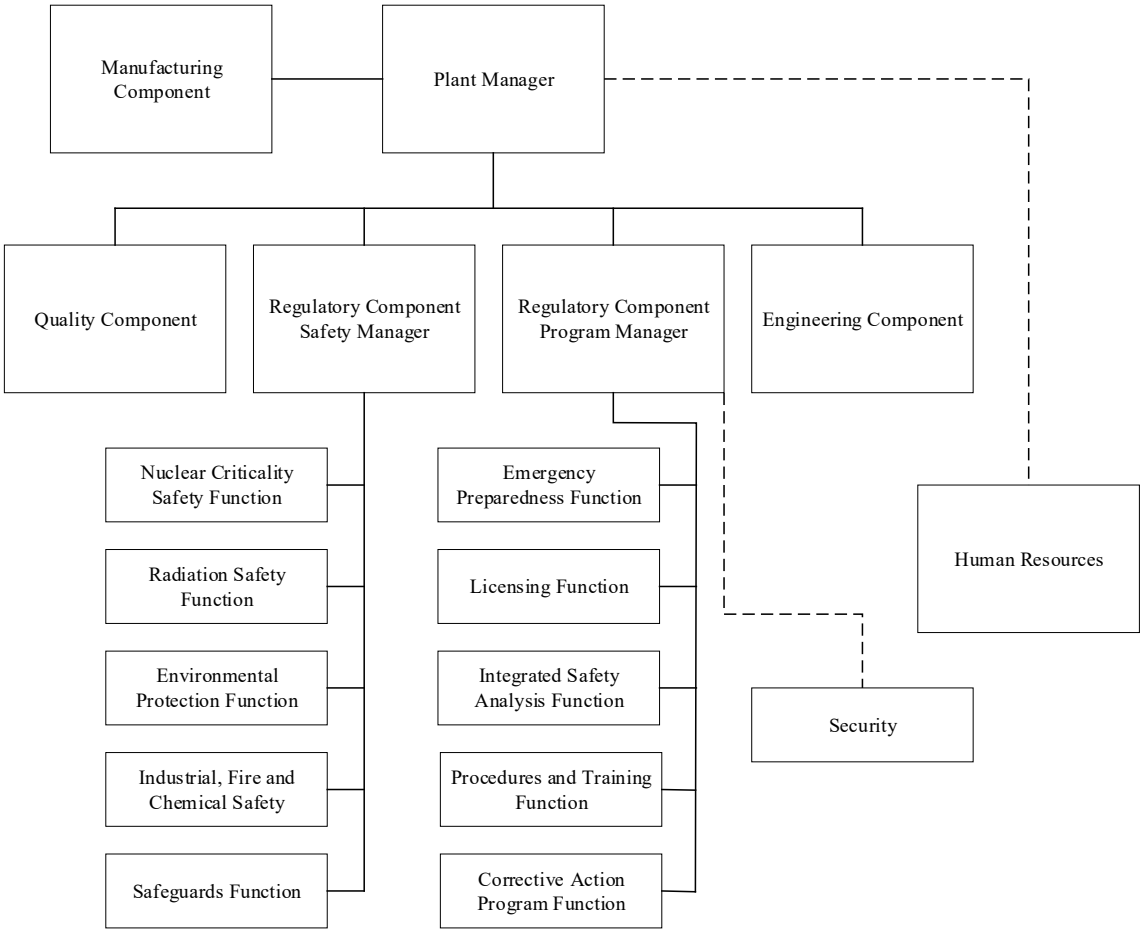
At the CFFF, personnel involved in operations at the facility have the right and are actively encouraged to question and/or request a review of the safety or security of any operating task or procedure. Concerns are given the proper priority based on their potential safety significance, and investigated, assessed and resolved in a timely manner. Further, members of the Regulatory Component have the responsibility and authority to prohibit, through the cognizant first level manager, any situation that is believed to involve an imminent hazard. Such terminated operations remain in a safe-shutdown state until the situation is reviewed with cognizant management, and there is a consensus resolution of the situation.

### 2.1.1.3 Position Accountability and Requirements

The CFFF Plant Manager has the ultimate responsibility for assuring that CFFF operations utilizing SNM are conducted in a manner that is protective of its workers, the public and the environment and that is in compliance with applicable Federal, State, and local regulations, licenses and permits. This is accomplished by putting in place an organization with defined accountabilities.

To the extent practicable, the Regulatory Component Safety Functions are administratively independent of the Manufacturing, Engineering, and Quality Components to prevent conflicts of interest. Figure 2.1 presents generic responsibilities within the CFFF organization structure. The lines of communication and authority among the Engineering, Manufacturing and Regulatory components are specified in approved position descriptions and in documented and approved policies and procedures.

**Figure 2.1 CFFF Organization**



(a) CFFF Plant Manager

The Plant Manager has overall accountability and responsibility for all nuclear fuel manufacturing activities at the CFFF. This individual directs activities of licensed operations and staff functions, either directly or through designated management personnel. This individual also coordinates any necessary support activities obtained from higher Westinghouse management and performs assigned management activities in accordance with Westinghouse policies and higher management directives.

The minimum requirements for immediately assuming the position of CFFF Plant Manager are a baccalaureate degree or equivalent, five years of management experience in the nuclear business, and a broad general knowledge concerning the regulatory aspects of policies and procedures at the CFFF. A Plant Manager-in-training that does not meet these minimum requirements formally designates an individual that does meet these requirements, to provide direct advice and consultation, until the minimum requirements are fully met. Typically, this designated advisor is a Senior Manager of the Regulatory Component or the incumbent Plant Manager.

(b) CFFF Managers

Component Managers (Senior Component Managers are typically called Plant Staff Managers, mid-level Component Managers are typically called Area Managers) have specific accountability for manufacturing, engineering, regulatory and product quality activities and operations involving licensed materials. To the extent practicable, the Regulatory Component Safety Functions are administratively independent of the Manufacturing, Engineering, and Quality Components.

Component Managers plan, direct, and control activities personally, or through subordinate management personnel; and, perform assigned management duties in accordance with Westinghouse policy and higher management directives. A Component Manager might be responsible for more than a single work area; and, is directly accountable for the safe operation and control of activities in their assigned work area(s). With appropriate support from cognizant service groups, Component Managers are responsible for safety, safeguards and quality in areas over which they have authority. Senior Component Managers report directly to the CFFF Plant Manager.

The Manufacturing Component conducts operations and maintenance activities required for the production of nuclear fuel. The Engineering Component provides technical support and design services pertaining to processes and facilities used by the Manufacturing Component and others. The Regulatory Component is described below in paragraph (c) of this subsection. The Quality Component provides assurance, inspection, and analytical services in support of the Manufacturing Component, Regulatory Component and others.

Component Managers are knowledgeable in the operating procedures applicable to their work areas, including the application of the CFFF's safety programs, as they relate to controls and limitations on work activities, in assigned radiation and radioactive materials areas. Each manager of work areas where uranium is handled is knowledgeable in the application of the areas' NCS controls and other safety controls identified in the ISA. Managers are also knowledgeable in the occupational safety and health practices applicable to their areas of responsibility.

The minimum requirements for a position of Component Manager are a baccalaureate degree, or equivalent, with a science or engineering emphasis; and, two years of experience in the nuclear business. A Component Manager-in-training that does not meet these minimum requirements has an individual, formally designated by the next highest level of management, to provide direct advice and consultation, until the minimum requirements are fully met. Typically, this designated advisor is an individual who formerly held the position, another Component Manager, or an individual (or individuals) experienced in the skills needed by the Component Manager-in-training.

First Level Managers (typically called Team Managers) normally supervise operations personnel. These Managers fulfill their responsibilities by assuring that operations under their control are carried out in accordance with the radiation safety limits, NCS controls, processing procedures, schedules, and other instructions supplied by higher management.

The minimum requirement for a position of First Level Manager is a High School Diploma, or equivalent, and two years of experience in the nuclear business. A First Level Manager-in-training that does not meet these minimum requirements has an individual, formally designated by the next highest level of management, to provide direct advice and consultation, until the minimum requirements are fully met. Typically, this designated advisor is an individual who formerly held the position, another First Level Manager, or an individual (or individuals) experienced in the skills needed by the First Level Manager-in-training.

(c) Regulatory Component Managers and Engineering Functions

The Regulatory Component establishes requirements for safety, safeguards and licensed programs; and, for evaluating the effectiveness and compliance of these programs. The Regulatory Component is responsible for assuring that these requirements have been evaluated and communicated to other Component management for incorporation into facilities, equipment, and procedures prior to processing licensed material. Typical responsibilities of the Regulatory Component include:

- License and permit administration;
- Routine surveillance of operations;
- Maintenance of CFFF regulatory plans, manuals and/or procedures;

- Conduct and maintenance of the ISA and ISA Summary;
- Administration, review and approval of CFFF procedures involving safety and safeguards requirements;
- Review and approval of design drawings of equipment and layouts associated with the processing, handling and storage of licensed material;
- Verification of installed equipment for conformance to requirements for safety and safeguards; and, for documentation of said conformance;
- Assuring reviews are conducted of safety and safeguards aspects of changes to equipment and operations associated with the processing, handling, and storage of licensed material in accordance with the governing regulations;
- Administration, review and approval of safety and safeguards training and assuring its effectiveness;
- Monitoring and reporting the effectiveness of the program for assuring that radioactivity and radiation, exposures are kept As Low As Reasonably Achievable (ALARA);
- Administration, review and assessment of regulatory programs and performance; and,
- Review of regulatory violations and assurance of implementation of corrective actions.

The Regulatory Component is responsible for the establishment, conduct, and continuing evaluation of licensed activities to assure the protection of CFFF employees, the public, and the environment. This includes establishing criteria for the performance of reviews and approvals required by 10CFR70.72. In particular, for any processing change that could result in a credible consequence not previously evaluated, or in excess of one that that was previously evaluated, the Regulatory Component performs a safety analysis to assure that no off-site consequences, exceeding those specified by applicable regulations, could occur.

The Radiation Safety Program administered by the Regulatory Component includes, at minimum:

- The development of procedures to control contamination, exposure of individuals to radiation, and integrity/reliability of radiation detection instruments;
- The evaluation of radioactive effluents and material releases from the site;
- A program for maintaining exposures to radiation and radioactive materials, and releases of radioactive materials to the environment, ALARA;
- The maintenance of required records and reports to document Radiation Safety Program activities; and
- The authority to shut-down an operation when an imminent hazard is evident.

The NCS Program administered by the Regulatory Component includes, at minimum:

- The performance of process and equipment criticality safety evaluations before a new or modified fissile material operation is first operated;
- The determination of parametric controls and spacing requirements, based upon validated analytical or computational techniques, including computation of effective neutron multiplication factors for fissile material configurations;
- The conduct of assessments to assure operations are being conducted in accordance with approved NCS procedures and practices;
- The support of audits of the NCS program;
- The documentation and maintenance of process, equipment and program reviews; of validated NCS evaluations; and of operations equipment and procedure reviews, verifications, and approvals; and
- The authority to shut-down an operation when an imminent hazard is evident.

The Occupational Safety and Health Program administrated by the Regulatory Component includes, at minimum:

- The evaluation of potential physical, chemical, and fire hazards at the CFFF;
- The development and implementation of safety programs and procedures designed to minimize accidents and injury of employees;
- The procurement and maintenance of industrial safety protection and monitoring equipment;
- The development and implementation of a program for minimizing exposures to hazardous materials, and releases of hazardous materials to the environment, below permissible values;
- The support of audits of licensed activities for compliance with applicable regulations, licenses and permits; and, documentation of these audits, and actions to facilitate necessary corrective actions;
- Training in, and monitoring the training effectiveness of, chemical safety, and safety and health programs;
- Review and approval of CFFF procedures involving fire and chemical safety and occupational safety and health requirements;
- Verification of installed equipment for conformance to requirements for fire and chemical safety and occupational safety and health; and, for documentation of said conformance;
- Review and assessment of fire and chemical safety, and safety and health, programs and performance;
- The maintenance of required records and reports to document Occupational Safety and Health Program activities; and
- The authority to shut-down an operation when an imminent hazard is evident.

(d) Regulatory Component Managers and Engineering Qualifications

The minimum requirements for a position of a Regulatory Component Manager are a baccalaureate degree, or equivalent, with a science or engineering emphasis and two years of experience in assignments involving regulatory activities in the nuclear business. A Regulatory Component Manager-in-training that does not meet these minimum requirements has an individual, formally designated by the next highest level of management, to provide direct advice and consultation, until the minimum requirements are fully met. Typically, this designated advisor is an individual who formerly held the position, another Regulatory Component Manager, or an individual (or individuals) experienced in the skills needed by the Regulatory Component Manager-in-training. A Regulatory Component Manager has appropriate knowledge of health physics, NCS, and/or industrial safety and hygiene (typically demonstrated by completion of formal courses in one or more of the disciplines and/or by having prior work experience in one or more of the disciplines) and is knowledgeable in administration of functional programs being managed.

The minimum requirements for a position of a Regulatory Function Engineer are a baccalaureate degree, or equivalent, with a science or engineering emphasis and two years of experience in positions involving assigned function activities, in the nuclear business. A Regulatory Function Engineer-in-training that does not meet these minimum requirements has an individual, formally designated by a Regulatory Manager, to provide direct advice and consultation until the minimum requirements are fully met. Typically, this designated advisor is an individual who formerly held the position, another Regulatory Function Engineer, or an individual (or individuals) experienced in the skills needed by the Engineer-in-training. A Regulatory Function Engineer has knowledge in the execution of assigned function programs (typically demonstrated by formal performance reviews by a Regulatory Component Manager) and in administration of assigned functional programs.

### 2.1.1.4 Management of Organization Changes

Approved procedures are in place to assure that relevant organizational changes within the Regulatory Component, and external to the Regulatory Component, are reviewed for impact on safety and safeguards and other regulatory requirements.

(a) It is the responsibility of each CFFF Component to submit organizational changes involving managers and engineers, with assignments of regulatory relevance, to the Regulatory Component so that the regulatory impact of the changes can be assessed. The assessment considers the structure of the organizational change, the capabilities and skills of the personnel involved, and any resultant changes to organizational responsibilities.

(b) It is the responsibility of the Regulatory Component to assess Regulatory Component organizational changes so that the regulatory impact of the

changes can be determined. The assessment considers the structure of the organizational change, the capabilities and skills of the personnel involved, and any resultant changes to organizational responsibilities.

(c) Organizational changes external to the Regulatory Component, involving personnel other than managers and engineers are submitted to the Regulatory Component for assessment only if the responsible manager determines that safety, safeguard, and/or other regulatory activities could be impacted.

(d) Assessment considerations include both normal and off-normal operations (and any transitional phases), and potential for cumulative effects of organizational changes, as appropriate.

(e) The extent and detail of an assessment are commensurate with the level of risk for an adverse impact on regulatory activities determined for the organizational change.

(f) If a significant risk of an adverse impact on regulatory performance is identified, an organizational change is closely monitored using the Corrective Active Program (CAP), described in Section 3.8 of this License Application, until the risk is resolved.

(g) Organizational changes are reviewed prior to implementation, whenever practicable.

# CHAPTER 3.0

# MANAGEMENT MEASURES

Conduct of operations incorporates the management measures implemented on a continuing basis to reasonably assure that CFFF activities for protection of the environment, health and safety of employees and the neighboring public are conducted to a high standard of quality. In particular, these management measures are applied to IROFS to provide reasonable assurance they are available and reliable to perform their intended functions when needed.

At the CFFF, the management measures applied to IROFS are specified in the ISA Summary. These management measures are applied to IROFS based on the type of control, i.e., engineered or administrative.

## 3.1 CONFIGURATION MANAGEMENT (CM)

A formal review and approval process has been established to analyze new structures, systems, and components, or modifications to existing structures, systems, and components. The Engineering Component is responsible for establishing and maintaining the CM program to provide control of design and safety information and records of modifications that might impact the ability of IROFS to perform their safety function when needed. Prior to implementing these changes, the following items are addressed and documented:

- The technical basis for the change;
- Impact of the change on safety and health or control of licensed material;
- Modifications to existing drawings, procedures and training;
- Authorization requirements for the change;
- For temporary changes, the approved duration (e.g., expiration date) of the change; and
- The impacts or modifications to the ISA, ISA Summary, criticality safety evaluation or other safety program information, developed in accordance with 10CFR70.62 and 10CFR70.64.

The Regulatory Component reviews and approves CM submittals.

The CM program includes the following key elements to assure that information used to operate and maintain safety controls are kept current:

***Design Requirements*** are governed by written plant procedures which control the development, application and maintenance of design specifications and requirements. Plant design specifications and requirements are maintained as controlled information. The specific content of the information depends on the age of the design and the requirements

at the time of the design. Design requirement procedures also assure consistency between the facility design, physical configurations and documentation.

***Document Control*** assures plant procedures are established to specify the requirements for review, approval, issuance and revision of documents important to CFFF safety and safeguards. Document control includes the following types of documents as applicable to the change:

- Technical specifications and requirements;
- Special procurement or construction provisions;
- Licensing documents;
- Drawings, procedures and training;
- Software for IROFS;
- Maintenance and surveillance; and
- ISA and identification of IROFS.

Document Control assures the availability of current approved plant documents for use by plant personnel.

***Change Control*** includes the elements of the CM program for controlling changes to the site, structures, processes, systems, equipment, components, computer programs, and activities of personnel. Approved plant procedures describe these controls and define the distinction between different types of changes, ranging from replacement with identical designs that are authorized as part of normal maintenance, to new or different designs that require specified review and approval. Changes to site, structures, processes, systems, equipment, components, computer programs, and personnel activities are evaluated under 10CFR70.72(a) before the change is implemented. Changes to onsite documentation are made to avoid inadvertent access by facility personnel to outdated design and other specifications pertaining to IROFS. Change control assures that modifications to IROFS are appropriately reviewed, approved, installed, tested and documented by the Engineering and Regulatory Components.

Changes involving fissile material operations are reviewed by the NCS organization. If a criticality safety evaluation is not required for the change, a justification is provided and documented. This justification includes evaluating whether the validity of any underlying assumptions is impacted by the proposed change.

***Audits*** of the CM program are systematically planned and performed in accordance with the requirements specified in Section 3.6 of this Chapter. The purpose of these audits is to evaluate the program's effectiveness and to correct any deficiencies.

***Design Reconstitution*** for the current plant design was completed in accordance with the requirements specified in 10CFR70.62. The CFFF submitted a plan as required by 10CFR70.62(c)(3)(i), and this plan was approved by the NRC. NRC approval of the initial ISA Summary was completed on August 20, 2007 (TAC NO. L31857).

Periodic ISA Summary updates as required by the regulations (10CFR70.72(d)(2&3)) are submitted to the NRC on an annual basis.

## 3.2 MAINTENANCE

To assure that maintenance activities do not have an adverse impact on safety and/or safeguards programs at the CFFF and to keep IROFS in a condition of readiness such that they are available and reliable to perform their intended function when called upon to do so, a maintenance program is implemented in accordance with approved procedures. The Maintenance Component is responsible for implementing and maintaining this maintenance program.

The maintenance program uses a computerized maintenance planning and control system to plan, track and maintain records for maintenance activities. This program assures IROFS are installed, tested and maintained in accordance with approved procedures. When maintenance activities require changes to existing facility design, equipment, components, physical configuration and safety documentation, these changes are performed in accordance with Section 3.1 of this Chapter.

"Maintenance" for administrative control IROFS is performed through the procedure review and approval process described in Section 3.4 of this Chapter. Periodic review of procedures is performed to assure their continued effectiveness and suitability for the IROFS to which they apply.

Maintenance activities are reviewed and approved by the Regulatory Component to assure safe work practices are appropriately specified and maintenance activities do not have an adverse impact on safety. Maintenance and surveillance activities are performed by trained and qualified personnel. During maintenance activities, abnormal occurrences (including unsatisfactory maintenance, calibration, inspection or functional testing of IROFS) are reported to the Regulatory Component as per the Incident Investigation and/or CAP, described in Sections 3.7 and 3.8 of this Chapter. The frequency of maintenance activities may be adjusted based on the operating experience of the IROFS performance. If maintenance activities require an IROFS to be taken out-of-service, it is done so using written procedures approved by the Regulatory Component.

IROFS may never be defeated, bypassed, over-ridden or forced off, unless specifically approved in advance by the Regulatory Component. Compensatory measures are applied while the process continues to operate to account for the unavailability of an IROFS that is taken out of service for maintenance. Procedures shall state the required conditions, time limits and controls to be maintained while a control is in By-Pass Operation.

IROFS may be forced "on" only when conducting operability tests in accordance with written procedures.

The Maintenance Program includes the following key elements:

***Corrective Maintenance*** refers to situations where repairs, replacements or major adjustments, such as re-calibration, take place. Maintenance work orders are typically used to initiate corrective maintenance. In some cases, corrective maintenance also requires the use of the CM program. Whenever components associated with IROFS are observed to be defective, the controlled operation is terminated until the safety control is returned to service or other compensatory controls, approved in writing by the Regulatory Component, can be temporarily instituted while the defective control is being replaced.

***Preventive Maintenance*** refers to activities that are performed as precautions to help assure systems remain operational and avoid unexpected failures. The CFFF performs preventive maintenance activities at specified frequencies to assure the availability and reliability of IROFS as per plant procedures. Periodic functional verification/testing of IROFS is performed in accordance with these preventive maintenance requirements. IROFS shall not be disconnected or removed from service (while the process continues to operate) during calibration or functional testing, unless authorized in a written procedure approved by the Regulatory Component.

***Surveillance and Monitoring*** refers to the established activities to monitor the current and long term performance of IROFS. The Operations Component monitors the performance of safety systems and IROFS while licensed activities are being conducted. Abnormal occurrences are reported to the Regulatory Component as per the Incident Investigation and/or CAP, described in Sections 3.7 and 3.8 of this Chapter.

***Functional Testing*** is performed to confirm the availability and reliability of IROFS. Functional testing is performed (1) as part of pre-operational testing for new or modified processes as prescribed by the CM program; (2) as part of preventive maintenance; and/or (3) as part of post-maintenance testing to verify that a routine or corrective maintenance activity did not adversely affect the functionality of the IROFS. Functional tests are performed in accordance with written instructions that define the method for the test and the required acceptable results.

## 3.3 OTHER QUALITY ASSURANCE ELEMENTS

With regard to 10CFR70, management measures are applied to IROFS to provide reasonable assurance that IROFS are available and reliable to perform their intended functions. A summary of how management measures generally meet the intent of the traditional 18 quality assurance elements follows:

- Organization – The CFFF operates to a documented organizational structure in which responsibility and authority for safe operations is clearly defined. Further discussion on the management organization is contained in Chapter 2.0 of this License Application. The Regulatory Component is responsible for assuring oversight of other quality assurance elements.
- Program – This License Application describes the programs to assure safe operations at the CFFF.

- Design Control – CFFF policies and procedures provide requirements for design control as required to assure the availability and reliability of IROFS. These requirements are described in Section 3.1 of this Chapter.
- Procurement Documentation Control – Procurement controls are applied to procured IROFS in accordance with written procedures.
- Instructions, Procedures, and Drawings – Licensed activities are performed in accordance with written instructions/procedures as defined in Sections 3.1, 3.2 and 3.4 of this Chapter.
- Document Control – The CFFF implements document control as described in this Chapter of the License Application. Any special procurement or construction provisions would be included in the CM requirements for that change.
- Control of Purchased Materials, Equipment, and Services – Control of Purchased Materials, Equipment, and Services is applied to IROFS in accordance with written procedures.
- Identification and Control of Materials, Parts, and Components – Identification and control of procured IROFS is performed in accordance with written procedures to assure that only correct items are installed and used.
- Control of Special Processes – Welding and nondestructive examination processes pertaining to IROFS are controlled in accordance with written procedures and conducted by qualified personnel.
- Internal Inspections – Inspections required to assure the availability and reliability of IROFS are performed in accordance with Sections 3.1 and 3.2 of this Chapter. Inspections describe the characteristics to be inspected and the methods to be used.
- Test Control – The CFFF implements a functional testing program for IROFS as defined in Sections 3.1 and 3.2 of this Chapter.
- Control of Measuring and Test Equipment – The CFFF maintains measuring, calibration, and test equipment in accordance with written procedures.
- Handling, Storage, and Shipping Controls – If applicable, special handling, storage and shipping controls applied to IROFS are specified in written procedures. Where shelf life is important, controls are implemented to assure these controls are implemented for the item.
- Inspection, Test, and Operating Status – If the ISA requires status indication, the IROFS are marked and tagged.
- Control of Nonconforming Materials, Parts, or Components – Nonconforming IROFS are controlled so that they are not used until such time as they are repaired and able to perform their intended function.
- Corrective Action – The CFFF has a CAP as defined in Sections 3.7 and 3.8 of this Chapter.
- Records – The CFFF maintains records as defined in Section 3.9 of this Chapter.
- Audits – The CFFF provides audits as defined in Section 3.6 of this Chapter.

## 3.4 PROCEDURES, TRAINING AND QUALIFICATION

At the CFFF, procedures, training and qualification are integrated to assure that safety and safeguards activities are conducted by trained and qualified individuals, in accordance with Westinghouse policies, procedures and commitments to Regulatory Agencies.

### 3.4.1 Procedures

Activities involving licensed material and/or IROFS are conducted in accordance with properly approved and issued procedures. Each component is responsible for establishing and maintaining its procedures. These procedures are reviewed and approved by an independent, multidisciplinary safety review team. Approved procedures provide the basis for training personnel, and users are trained to use the latest revision.

Following procedures assures safe and compliant activities are conducted at the CFFF. Specifically, procedures direct activities involving IROFS, management measures, site-wide industrial safety work practices, NCS, radiation safety, chemical process safety, fire safety, environmental protection, emergency management, material control and accounting, and physical security.

The procedure program specifies requirements and responsibilities for preparation; review and approval; distribution; control; validation; and periodic review of at least three (3) years to assure that procedures are technically accurate and can be performed as written. Procedures are approved by appropriate component management personnel who are responsible and accountable for the activity governed by the procedure. Procedures are maintained and controlled as records by an electronic training and procedure system.

CFFF procedures can be classified into general categories. Each procedure contains an identifying number, title, revision number and date.

***Management Control Procedures:*** Administrative procedures assign responsibilities and provide requirements for activities that do not involve manipulation, operation, modification, maintenance, testing, or calibration of plant equipment or real-time computer systems. These procedures provide the administrative and general CFFF regulatory requirements. Administrative procedures include applicable instructions on the purpose & scope, supporting documents, terms & definitions, roles & responsibilities, and instructions.

***Operating Procedures:*** Procedures give step-by-step process instructions and specify operator actions necessary to prevent or mitigate accidents identified in the ISA Summary. These procedures include applicable instructions on the purpose & scope, supporting documents, terms & definitions, prerequisites, instructions and acceptance criteria for instructions. Operating limits, administrative IROFS, and actions for start-up, normal operations, and shutdown are included as applicable in operating procedures. If a procedure cannot be followed as written, operators are instructed to stop; place the process

in a safe condition; notify first level management; and follow the requirements in Section 3.7 of this Chapter.

***Maintenance Procedures:*** Procedures are established to specify how maintenance activities are performed at the CFFF. These procedures assure maintenance work is executed with a level of rigor that is appropriate for the risk to personnel or public safety. Maintenance work activities are performed by trained personnel using the approved and current procedures. Post-maintenance testing and/or functional verification of IROFS is performed prior to the work being completed and accepted. Maintenance of passive engineered controls is based on the specific needs (e.g. duty, service, environment) of that control. Procedures governing the maintenance program and safe work practices are described in Section 3.2 of this Chapter.

***Emergency Procedures:*** Procedures governing the emergency management program and safe work practices are described in Chapter 9.0 of this License Application.

***Temporary Operating Procedures:*** Supplemental Operating Instructions (SOIs) can be used to provide a documented series of clear and concise steps that formulate a systematic sequence of work to be used on a temporary basis. SOIs may be authorized for use for a period of up to 6 months from the original issue date.

### 3.4.2 Training and Qualification

A performance-based training and qualification program supplemented by operating experience is implemented at the CFFF in accordance with approved procedures. The objective of this program is to assure individuals performing activities relied on for safety and using licensed material have the proper knowledge, skills and abilities to perform work activities in a safe and compliant manner. Component managers are responsible for establishing and documenting training requirements for personnel; identifying training needs; verifying proficiency annually; assuring personnel are properly trained and qualified; and assuring personnel do not work independently until training and qualification requirements are met.

General Employee Training (GET) is required for individuals who perform work at the CFFF. Job Specific Training is required for particular positions to assure activities relied on for safety are properly performed. Refresher training and/or requalification is performed on a periodic frequency.

The program procedure for training and qualification includes a process to analyze, design, develop, implement and evaluate the effectiveness of training to assure that training is conducted reliably and consistently. Training may be classroom; computer-based; on-the-job; self-study of procedures and work instructions; demonstration of skills which may include assignments and/or tests; and/or special training which may include conferences, courses, etc. Approved procedures provide the basis for the training content. Training

materials are updated to remain current with the latest revisions of procedures. Employees are refreshed as training is updated.

### 3.4.2.1 General Employee Training (GET)

New employees receive training in regulatory policies, safety and safeguards. Facility visitors are provided with training commensurate with their visit's scope, and/or are escorted by trained employees.

Radiation workers receive additional training and annual refresher training, requiring successful completion of an examination in accordance with 10CFR19 and 10CFR20. Radiation worker training topics include:

(a) ALARA principles;
(b) General health physics rules and practices;
(c) General NCS practices;
(d) Industrial safety and hygiene practices;
(e) Chemical Area work practices;
(f) Radiation risks;
(g) Fire safety practices;
(h) Environmental protection;
(i) Emergency planning; and,
(j) Safeguards.

### 3.4.2.2 Job Specific Training and Qualification

In addition to GET, individuals assigned to positions/activities involving licensed materials are trained and qualified to perform their job in a manner that does not adversely affect safety. Emphasis is placed on safety requirements where human actions are important to safety, including implementation of Administrative IROFS.

Management:
Qualification requirements for CFFF management positions are described in Chapter 2.0 of this License Application.

Operators:
The minimum education requirement for a process operator is a high school diploma or high school equivalency certificate. Process operators who perform work involving licensed SNM and/or IROFS are trained and qualified to perform work in accordance with approved procedures.

On-the-Job Training (OJT) is a key element of process operator qualification. OJT is performed by an OJT Trainer who instructs a process operator through demonstration, lecture, coaching and hands-on participation on how to perform specific tasks. OJT typically entails a trainee working and learning under the direction of a qualified person

while actually performing the task or job. The knowledge, skills and abilities required for a specific task are included on an Electronic Training Checklist (ECL). The ECL is used to document the completion of OJT. A Skills Matrix Report shows which ECLs an employee is qualified or not qualified to perform. Requalification is performed at the frequency required by procedure to verify an operator is still proficient on a task for which they have been previously qualified. If a qualification expires, the operator is disqualified and is treated as a trainee while the initial OJT Qualification Process is repeated.

Regulatory Component Personnel:
The program procedure for indoctrination, training and qualification of Regulatory Component personnel includes the necessary requirements to assure personnel are trained and qualified to perform specific regulatory activities in accordance with approved procedures and/or applicable regulations. Typically, this training is accomplished using several methods, e.g., computer-based courses, OJT by a qualified individual, and/or self-study of regulations, license applications, permits, ISA and procedures. Special training, including conferences, courses, etc. may also be required.

The individual's manager acknowledges completion of the training program by documenting that the trainee is qualified to independently perform job-specific activities. Unqualified personnel cannot approve regulatory documents unless the document is co-signed by a qualified individual who takes responsibility for the document.

The individual's manager also formally evaluates performance of skills and abilities on a continuing basis. When deficiencies or performance issues are identified, they are corrected immediately.

## 3.5 HUMAN PERFORMANCE

Human Performance (HuP) principles are employed at the CFFF in recognition of how the total job environment (structures, equipment, training, and procedures) shapes the expectations, thoughts, and decisions of employees who work with nuclear materials. The basis of HuP at the CFFF is a series of behaviors executed to minimize the frequency and severity of events. The basic purpose of HuP tools is to help the individual worker maintain positive control of a work situation.

HuP is based on an Institute of Nuclear Power Operations (INPO) model that provides a proven methodology to promote behaviors throughout the organization that support safe and reliable operations. The principles of HuP include:

(a) Humans are fallible;
(b) Error is predictable;
(c) Organization influences behavior;
(d) Behaviors are reinforced; and,
(e) Events are avoidable.

HuP tools are used to recognize error likely situations and prevent events from occurring. These tools include but are not limited to Questioning Attitude; Self Check; Peer Check; Pre-Job Brief and Post-Job Review; Time-Out; Decision Making; Independent Verification; Signature; Situational Awareness; Validate Assumptions; Effective Communication; Procedure Use and Adherence; and Personal Safety Assessment.

CFFF employees are trained in HuP concepts, commensurate with the level of their participation in the program. Management conducts observations that focus on high-risk or error-likely processes. Observations are an important attribute of CFFF continuous improvement programs.

## 3.6 AUDITS

Audits are conducted to assure that activities important to safety and safeguards are properly documented, are conducted in accordance with such documentation and meet management expectations with respect to effectiveness. Audits are periodically performed on the Management Measures described within this Chapter of the License Application. Audits are also performed in the areas of NCS, Radiation Safety, Chemical Safety, Fire Safety, Environmental Protection, ISA, Emergency Management and Safeguards.

The Regulatory Component oversees an internal audit program to verify that operations are being performed in compliance with regulatory requirements and license commitments.

A comprehensive system of planned and periodic audits is carried out to verify compliance and to determine the effectiveness of the program. The audits are performed in accordance with the written procedures or checklists. Audit results are documented and reviewed by management having responsibility in the area audited. Follow-up action, including re-audit of deficient areas, is taken as needed.

An annual schedule for formal audits is planned, documented, revised, and implemented. The frequencies of audits are established by regulatory requirements, management commitments and company or industry policy. Assigned Westinghouse personnel, and/or external auditors selected by Management, conduct the audits in accordance with an approved procedure. Audits are led by qualified personnel, who do not have direct responsibility for the activity being audited.

Appropriate follow-up activities to assure corrective actions are implemented effectively are conducted through the CAP. Corrective actions from previous audits are reviewed during the initiation of the next audit.

## 3.7 INCIDENT INVESTIGATIONS

A formal process exists for internal reporting and investigation of abnormal occurrences (*e.g.,* regulatory events, issues with IROFS and management measures, process upsets, procedural inadequacies, etc.) that occur during operations at the CFFF. This process is used to identify, track, investigate and implement corrective actions for abnormal occurrences. The process includes the following requirements and features:

- Requirements for the Incident Investigation Process are described in written procedures.
- Abnormal occurrences are documented, tracked and reported to appropriate management in the Operations, Engineering, Product Assurance and/or Regulatory Components.
- Abnormal occurrences involving IROFS or their associated management measures are specifically identified.
- Each abnormal occurrence is considered in terms of regulatory reporting criteria, and appropriate notifications are made if required by regulation or procedure.
- Abnormal occurrences are considered in terms of severity and compliance with regulations or license conditions.
- Abnormal occurrences involving IROFS require investigation, a determination of the probable cause, consideration of the extent of condition, and identification of required corrective action. This is consistent with the CAP.
- Procedures may require revision following an abnormal occurrence.
- Abnormal occurrences are periodically trended and summarized by the Regulatory Component, per procedure, to identify repetitive failures and generic issues. Additional evaluation, corrective actions and continuous improvement activities may be initiated as a result of this trend analysis. Also, the performance of IROFS is reviewed, and unacceptable performance deficiencies are corrected. If necessary, updates to the ISA and ISA Summary documents are performed to correct underestimated performance.

## 3.8 CORRECTIVE ACTION PROGRAM (CAP)

The CFFF maintains a CAP that provides a structured, disciplined approach to identify, document, and correct conditions adverse to safety and security. The CAP employs a computerized system which complies with Regulatory Guide 3.75, Revision 0 Section C.

## 3.9 RECORDS MANAGEMENT

The CFFF identifies, preserves, controls and destroys regulatory records in accordance with a records management system. This system is implemented in accordance with approved administrative procedures which describe the roles and responsibilities for the

Records Program and requirements for creation, protection, retention, retrieval, and disposition of records. Regulatory records provide a complete, authenticated document which furnishes evidence of compliance with applicable federal and state regulations and other salient matters.

As part of this program, a Records Flow Schedule (RFS) is maintained and provides an index of records generated and/or controlled by the Regulatory Component. The RFS describes the records to be retained, retention locations and retention time limits. The general categories of these records include radiation protection, criticality, environmental, licenses/permits, procedures, training, safeguards, safety, emergency preparedness and miscellaneous.

Records associated with ISAs are included in the general category for licenses/permits. Records pertaining to IROFS and associated with Configuration Management document control, Maintenance, and other quality assurance elements are also included in this category and are retained for three years. Records associated with the IROFS and management measures failures required by 10CFR70.62(a)(3) and with abnormal occurrences involving IROFS are retained for a minimum of 3 years or as otherwise required by federal regulation.

Individual records for training, qualification and requalification are typically maintained and controlled in an electronic training and procedure system. Some training records, such as job specific training and qualification of Regulatory Component personnel, are retained as paper copies and are stored for the qualification period.

Records specifically required for new facilities or new processes at existing facilities as required by 10CFR70.64(a) are maintained in accordance with those regulations.

Records associated with Decommissioning are described in Chapter 11.0 of the License Application.

Records are properly identified, including a “permanent” or “nonpermanent” classification, and can be retrieved in a timely manner. Records must be legible, identifiable and retrievable for their designated lifetimes. Records are protected against tampering, theft, loss, unauthorized access, damage, or deterioration while in storage.

Retained records are stored and maintained readily accessible in order to meet retrieval time restraints. This records retention system includes the capability to retrieve records within 24-hours for records generated within the preceding 12-months and within 7-calendar-days for older record generation periods.

Prudent measures of redundancy and protection are maintained such that acts of record alteration or inadvertent destruction do not foreclose the capability for reconstructing a complete and correct set of required records. In cases where such measures fail, and a particular record is lost or destroyed, a reconstruction may be generated using source data

applicable to the time the subject record was originally created. When a record is just partially missing, all salvaged portions are attached to the reconstruction. If source data is not available for re-creating a missing record, the record may be reconstructed using inference to data relative to other records for similar information and time periods.

# CHAPTER 4.0

# INTEGRATED SAFETY ANALYSIS (ISA)

## 4.1 ISA PROGRAM STRUCTURE

The CFFF has developed and maintains an ISA and ISA Summary for the site. The ISA is a systematic analysis to identify facility and external hazards and their potential for initiating events, the potential accident sequences, their likelihood and consequences, and the selection of IROFS.

The "*Integrated Safety Analysis Handbook*" provides details describing the key features and practices for (1) the conduct of a baseline ISA of the plant site and structures, (2) baseline system ISAs of plant operations, and (3) preparation of ISA summaries. It defines team organization and skills, analytical rules and assumptions, techniques, and deliverables required to enable an analysis to be performed. The document embraces all aspects of the CFFF ISA Plan and Schedule submitted to, and approved by, NRC staff in accordance with 10CFR70.62(c)(3)(i). The original handbook and subsequent revisions are approved by the Regulatory Component Senior Manager.

### 4.1.1 The ISA

An ISA begins as a baseline document. This document identifies equipment and operations presenting hazards, and the control features that are relied upon for protection of the environment, and the health and safety of facility employees and the neighboring public.

The ISA and ISA Summary are developed in accordance with 10CFR70 regulations. Each ISA is performed in accordance with the requirements identified in this license application.

In general, the ISA provides:

- a description of the structures, equipment, and process activities at the facility;
- an identification and systematic analysis of hazards at the facility;
- a comprehensive identification of potential accident/event sequences that would result in unacceptable consequences, and the expected magnitudes and likelihoods of those sequences;
- an identification and description of implemented IROFS to limit or prevent potential accidents or mitigate their consequences; and
- an identification of management measures taken to assure the availability and reliability of identified safety systems.

The ISA is written in an appropriate level of detail for the complexity of the process and identifies radiological hazards pertaining to possessing or processing licensed material at the CFFF as well as chemical hazards of licensed material and hazardous chemicals

produced from licensed material. The ISA includes facility hazards that could affect the safety of licensed materials. The ISA also identifies potential accident sequences caused by process upset situations and credible external events. Operational Experience (OE) from other facilities, generic communications from NRC, and other sources are reviewed for applicability to the ISA, and the ISA may be revised based on insights learned from the OE. OE is entered into the CAP described in Chapter 3.0 of this License Application.

Credible accident sequences are identified using the methodologies listed in NUREG-1513, "*Integrated Safety Analysis Guidance Document*" (e.g., Hazard and Operability Analysis (HAZOP), What-if/checklist analysis, Failure Modes and Effects Analysis (FMEA), Fault Tree/Event Tree Analysis, etc.). The choice of a particular method or combination of methods depend on a number of factors including the reason for conducting the analysis, the results needed from the analysis, the information available, the complexity of the process being analyzed, the personnel and experience available to conduct the analysis, and the perceived risk of the process.

The ISA is performed by a team consisting of members with expertise in the safety disciplines being evaluated and with members familiar with the process, engineering, and operations involved. Updates to the ISA and the ISA Summary are performed by individuals with the same levels of expertise as the original team members.

Figure 4.1 outlines the Accident Sequence Risk Evaluation Process. Table 4.1 is the Risk Analysis Table and represents the acceptance criteria used in the ISA Documents. The criteria for determining accident sequence consequences are shown in Table 4.2. The criteria for determining the indices for the likelihood of initiating events and probability of IROFS failures are defined in Table 4.3 and Table 4.4. Alternatively, published failure data can also be utilized.

#### 4.1.1.1 The ISA

The ISA consists of baseline documents for the following CFFF systems:

(a) Site and Structures;
(b) Plant Ventilation;
(c) Chemicals Receipt and Storage;
(d) Storage of Uranium Bearing Materials;
(e) ADU Conversion;
(f) ADU Bulk Blending;
(g) Pelleting;
(h) ADU Fuel Rod Area;
(i) Burnable Absorber Fuel Processing;
(j) Burnable Absorber Fuel Rod Manufacturing;
(k) Erbia;
(l) Final Assembly Area;
(m) Scrap Uranium Processing;

(n) URRS Cylinder Wash;
(o) Safe Geometry Dissolver;
(p) URRS Solvent Extraction;
(q) Uranyl Nitrate Bulk Storage;
(r) Hoods and Containment;
(s) Wastewater Treatment;
(t) Low Level Radioactive Waste Processing; and,
(u) Laboratories.

### 4.1.2 The ISA Summary

An ISA Summary is generated from information extracted directly from the ISA. An ISA Summary (1) presents key aspects of the ISA in sufficient detail to enable an independent overview of the subject systems, and (2) provides reasonable assurance that operation of these systems will not lead to a situation that would exceed the performance requirements specified in 10CFR70.61. The ISA Summary is submitted to the NRC and is updated as appropriate to reflect any safety-significant changes.

#### 4.1.2.1 ISA Summary Content

The ISA Summary includes the following information:

(a) Site

The site description focuses on those factors that could affect safety, such as geography, meteorology (*e.g.*, high winds and flood potential), seismology, demography, and nearby industrial facilities and transportation routes.

(b) Facility

The facility description focuses on features that could affect potential accidents and their consequences. Examples of such features include facility location, facility design information, and the location and arrangement of structures on the facility site.

(c) Processes, Hazards, and Accident Sequences

The process description addresses each process that was analyzed as part of the ISA. This description also includes a discussion of the hazards (and interactions of hazards) for each process and the accident sequences that could result from such hazards, and for which the unmitigated consequences could exceed the performance requirements of 10CFR70.61.

(d) Demonstration of Compliance with 10CFR70.61

For each applicable process, the following information, developed in the ISA, is presented to demonstrate compliance with the performance requirements of 10CFR70.61:

1. Postulated consequences and comparison to the consequence levels identified in the performance requirements, as well as information supporting the results of the consequence evaluation (e.g., inputs, assumptions, inventory, release path factors, etc.).
2. Information showing how CFFF established the likelihoods of accident sequences that could exceed the performance requirements of 10CFR70.61 (e.g., inputs, assumptions, justification of the accident sequence likelihood, etc.).
3. Information describing how designated IROFS protect against accident sequences that could exceed the performance requirements of 10CFR70.61.
4. Information on management measures applied to IROFS.
5. Information on how the criticality monitoring requirements of 10CFR70.24 are met.
6. When applicable, how the baseline design criteria of 10CFR70.64 are addressed.

(e) Team Qualifications and ISA Methods

A discussion of the ISA Team's qualifications and ISA methods used is presented. Specific examples of the application of ISA methods are included as necessary to demonstrate appropriate selection and use.

#### 4.1.2.2 ISA and ISA Summary Maintenance

The ISA and ISA Summary are maintained current through implementation of the Configuration Management program described in Section 3.1 of this License Application and in accordance with 10CFR70.72. Subsequent changes that might affect the Baseline ISA are reviewed by the appropriate safety disciplines. If additional safety analyses are required for the change, they are performed to the current standards required for the Baseline ISA. Summary details of the change, including required approvals, are documented on a Configuration Change Control Form that is maintained as a record associated with the applicable Baseline ISA, thus providing a substantially complete "living" framework for the facility safety basis.

New or additional IROFS will be designated and management measures will be applied resulting from the evaluation of configuration control changes to the facility or its operation. Existing IROFS and the management measures associated with them will be evaluated for adequacy if they are impacted by configuration changes to assure that the risk associated with a previously analyzed accident sequence remains acceptable and to designate additional or different IROFS, if necessary.

The ISA Summary is submitted to the NRC, and is maintained as current, stand-alone documents. When a substantive change to the ISA Summary requires NRC pre-approval under 10CFR70.72, the NRC Licensing Project Manager is apprised, and an amendment request is submitted. When the CFFF makes a change to the ISA Summary that does not require NRC pre-approval under 10CFR70.72, an update to the ISA Summary is submitted to the NRC annually, within 30 days after the end of the calendar year during which the change occurred.

### 4.1.3 Audits

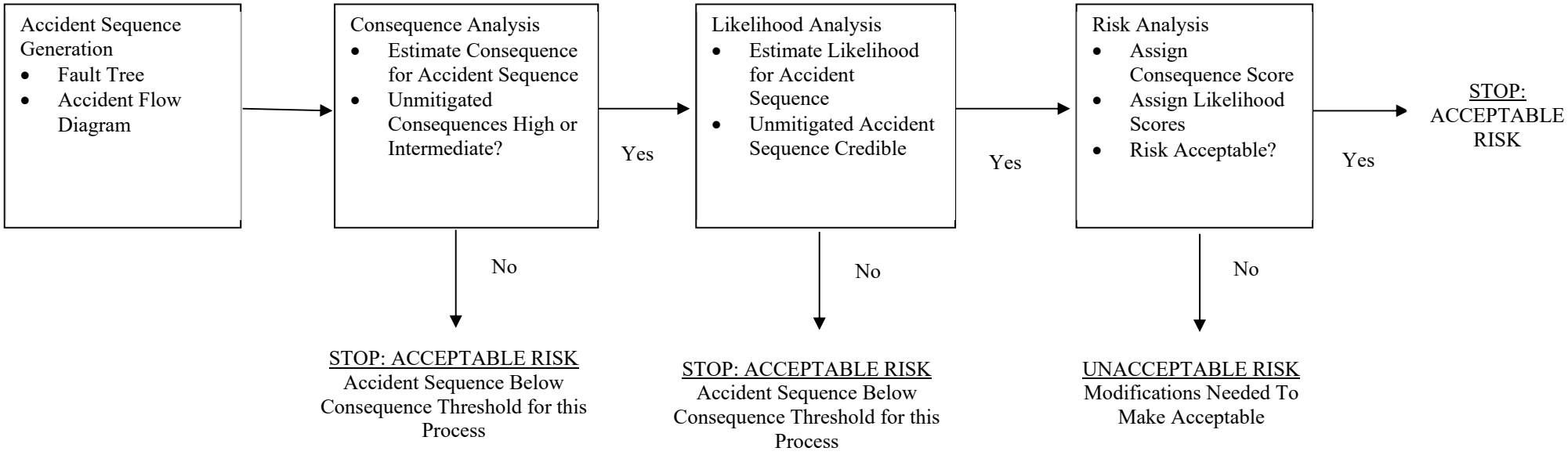
Audits are conducted to compare established ISA requirements to CFFF performance. These audits are performed in accordance with the requirements in Section 3.6 of this License Application.

- The ISA Program is audited on a triennial frequency and includes all aspects of the program described in this chapter.

- The CFFF ISA is audited on a five year frequency.

- Results of the audit are documented, and findings are put into the CAP and maintained for NRC Staff review and inspection.

**Figure 4.1 Accident Sequence Risk Evaluation Process**



## Table 4.1 Risk Analysis Table

Overall Likelihood of Accident

| Severity of Consequences | Highly Unlikely | Unlikely | | Not Unlikely | | |
|---|---|---|---|---|---|---|
| | -4 | -3 | -2 | -1 | 0 | 1 |
| High | | | | | | |
| Intermediate | | | | | | |
| Low | BELOW SEVERITY THRESHOLD | | | | | |

= Risk Zone 1 (Does not meet performance criteria; unacceptable risk for continued operation)

= Risk Zone 2 (Meets performance criteria but unacceptable risk for long-term operation)

= Risk Zone 3 (Meets performance criteria; acceptable risk)

Note 1: When the overall likelihood is calculated quantitatively in units of "events per year," the exponent of the likelihood value is used. That is, for an event calculated to occur $4x10^{-5}$/ year, the overall likelihood index is -5.

Note 2: When the overall likelihood is calculated quantitatively, conservative rounding is applied. For example, a calculated event frequency of $9x10^{-4}$/ year would be given an index of -3.

Note 3: If the consequence level is neither high nor intermediate using the criteria in Table 4.1, (Low Severity), then the accident sequence is screened from further evaluation. That is, based on consequence alone, the risk associated with the accident sequence meets performance requirements. Therefore, estimating the likelihood of the accident is not required.

## Table 4.2 Accident Sequence Consequence

| Severity Ranking | Consequence Description | | |
|---|---|---|---|
| | Workers | Offsite Public | Environment |
| **High** | • Radiological dose greater than or equal to 1 Sv (100 rem) Total Effective Dose Equivalent<br>• 400 mg soluble uranium intake or greater<br>• Chemical exposure greater than or equal to ERPG-3<br>• A nuclear criticality accident | • Radiological dose greater than or equal to 0.25 Sv (25 rem) Total Effective Dose Equivalent<br>• 30 mg soluble uranium intake or greater<br>• Chemical exposure greater than or equal to ERPG-2 | • None |
| **Intermediate** | • Radiological dose greater than or equal to 0.25 Sv (25 rem) but less than 1 Sv (100 rem) Total Effective Dose Equivalent<br>• 150 mg soluble uranium intake or greater<br>• Chemical exposure greater than or equal to ERPG-2 but less than ERPG-3 | • Radiological dose greater than or equal to 0.05 Sv (5 rem) but less than 0.25 Sv (25 rem) Total Effective Dose Equivalent<br>• Chemical exposure greater than or equal to ERPG-1 but less than ERPG-2 | • A 24-hour averaged radioactive release outside the restricted area greater than 5,000 times Table 2 Appendix B of 10 CFR Part 20 |
| **Low** | • Accidents with radiological and/or chemical exposures to workers less than those above | • Accidents with radiological and/or chemical exposures to the public less than those above | • Radioactive releases to the environment producing effects less than those specified above |

* Sv = Sieverts; ERPG = Emergency Response Planning Guidelines

## Table 4.3 Occurrence Rate Scores for Initiating Events Analysis

| Score | Occurrence Rate | Qualitative Description and/or Example of Prevention Mechanism |
|---|---|---|
| 1 | 1/month | Expected to occur regularly during plant lifetime; prevention ineffective |
| 0 | 1/year | Expected to occur occasionally during plant lifetime; prevention by a trained operator performing a non-routine task |
| -1 | 1/10 years | Expected to occur sometime during plant lifetime; prevention by a trained operator performing a routine task |
| -2 | 1/100 years | Not expected, but might occur during plant lifetime; prevention by a functionally tested hardware and/or software system |
| -3 | 1/1,000 years | Not expected to occur during plant lifetime; prevention by an inspected passive device, or a functionally tested hardware and/or software system with trained operator backup |
| -4 | 1/10,000 years | Physically possible (credible) but not expected to occur; prevention by two independent, redundant methods or systems each functionally tested (consistent with double contingency protection and control) |
| -6 | — | Not credible (events determined to be *not credible* are those events that are not expected to be possible, based upon generally accepted physical or engineering principles; if an initiating event is determined to be *not credible*, then further analysis of the accident sequence progression is not necessary) |

## Table 4.4 Failure Probability for Protective Mechanisms

| Index Score | Failure Probability | Qualitative Description or Example of Protection Mechanism |
|---|---|---|
| 0 | 1 | No protection or extremely weak protection |
| -1 | 0.1 | Protection by a trained operator performing a non-routine task |
| -2 | 0.01 | Protection by a trained operator performing a routine task, or a functionally tested active safety device |
| -3 | 0.001 | Protection by an inspected passive safety device, or a functionally tested active safety device with trained operator backup. |
| -4 | 0.0001 | Protection by two independent, redundant safety methods or systems each functionally tested (consistent with double contingency protection) |

# CHAPTER 5.0

# RADIATION SAFETY PROGRAM

## 5.1 RADIATION SAFETY PROGRAM STRUCTURE

The CFFF maintains a Radiation Safety Program for the site. A primary purpose of the Radiation Safety Program is to assure that exposure of workers to radiation and radioactive materials is kept ALARA.

## 5.2 RADIATION SAFETY PROGRAM

**Definitions:**

5.2.1 The Derived Airborne Concentration (DAC) and Annual Limit on Intake (ALI) referenced in this Chapter, and used to calculate Committed Dose Equivalent (CDE) or CEDE, are based on the dose coefficients in the International Commission on Radiological Protection (ICRP) Publication No. 68.

**ALARA:**

5.2.2 The CFFF implements and maintains a Radiation Safety Program which assures that exposure of workers to radiation and radioactive materials is kept ALARA.

5.2.3 The Regulatory Component maintains occupational exposure and exposure to members of the public ALARA by:

- Establishing an ALARA committee, whose membership consists of Radiation Safety, Environmental Safety, other EH&S personnel, operations managers, and/or professionals, as needed. The ALARA committee meets at least annually to set goals, implement required changes and review ALARA performance. The ALARA committee assures radiation exposures do not exceed 10CFR20 limits under normal operations.
- Generating specific ALARA requirements and goals.
- Including ALARA requirements in operating procedures.
- Assigning responsibility and authority for implementing ALARA requirements to first level managers.
- Incorporating and approving ALARA considerations in the design of new or modified facilities and equipment.
- Including ALARA principles and requirements in required training sessions.

5.2.4 The appropriate Senior Component Manager, whose level of reporting and independence from operations is described in Section 2.1.1.3(b) of this License

Application, maintains oversight of the CFFF commitment to assure exposures to radiation and radioactive materials remain ALARA.

5.2.5 Short-term ALARA progress is tracked by the Regulatory Component through a formal quarterly evaluation. This is reported to the ALARA committee and management, as appropriate.

5.2.6 Long-term ALARA progress is tracked by the Regulatory Component through a formal annual evaluation and documentation of performance indicators. The results of this evaluation are reported to the ALARA committee and management, as appropriate.

5.2.7 The annual ALARA evaluation and report are used to satisfy the 10CFR20.1101(c) requirement for annual review of radiation safety program content and implementation.

**Radiation Work Permits:**

5.2.8 A Radiation Work Permit (RWP) is required for work where radiation safety requirements are not specifically covered by an approved procedure and one or more of the following conditions are met:

(a) Potential for release of contamination outside of a Contamination Control Area that may result in contamination of personnel or equipment.

(b) The average local concentration of radioactive contaminants is predicted to exceed 50-percent DAC.

(c) The deep dose equivalent is predicted to exceed 100 millirem in a week.

(d) The Total Effective Dose Equivalent (TEDE) is predicted to exceed 10-percent of the 10CFR20 limit.

5.2.9 The RWP contains the following requirements and information:

- Personnel Qualification forms
- Procedure lists
- Approved Personnel List
- EH&S Operations Surveillance forms
- Copy of Configuration Control form (as applicable)
- Installation package (as applicable)

- Specific protection requirements as determined by the regulatory component.

5.2.10 The RWP is posted at the work site.

5.2.11 Only personnel who have completed required safety training and are on the approved personnel list are assigned to work under an RWP.

**Ventilation Systems:**

5.2.12 Ventilation control systems are installed and used whenever they are determined to be required by the Radiation Safety Function.

5.2.13 Ventilation systems are designed and operated to assure adequate control of radioactive dust and particulate. They are monitored and corrected as needed on a routine basis specified by the Radiation Safety Function. Air flows are typically maintained from non-chemical process areas to chemical process areas. Whenever adverse air flows are detected, corrective actions are taken as soon as practicable.

5.2.14 During work operations, ventilation systems, servicing primary enclosures where uncontained radioactive material is handled, provide minimum face velocities of 100-linear feet per minute. Enclosure velocities are tested quarterly; and systems which fail to meet the velocity criteria are either corrected immediately or tagged out of service until corrected.

5.2.15 Gloveboxes or similar enclosures are used when containment by conventional ventilation hoods is not possible or is not practical.

- These systems are designed and operated at a negative pressure with respect to room air, unless positive pressure is specifically approved by the Radiation Safety Function.
- These systems are equipped with instrumentation for measuring differential pressure.
- The operability of instrumentation is checked periodically.

5.2.16 When positive pressure enclosures are required for a purpose specifically approved by CFFF management, they are designed and operated according to control criteria approved by the Radiation Safety Function, including monitoring on a routine basis. The following criteria apply:

- The gloveboxes are designed for high integrity containment and moisture control.
- The gloveboxes are operated at a nominal positive internal pressure; and, in-plant air sampling is used to verify containment of radioactive material.

- Internal atmospheres are continuously re-circulated through HEPA filters.
- Alarms are provided to indicate when pressure exceeds the pre-set positive pressure limit.
- An interlock, or other pressure relief device, is provided to exhaust the glovebox with a sufficient factor of safety to assure its continuing integrity.

5.2.17 Ventilation hoods and gloveboxes are constructed primarily of metal, and use glass and/or UL fire rated plastic for viewing areas. UL-586 high efficiency particulate air filters are used for radiological purposes.

5.2.18 Ventilation ducts are designed to minimize accumulations of radioactive material, and are inspected on a frequency commensurate with the potential for accumulation.

5.2.19 Exhausts from hoods, gloveboxes, and similar enclosures are passed through HEPA filtration that is monitored on a routine basis to assure they meet maximum differential pressure limits approved by the Radiation Safety Function. The HEPA filters are replaced using one or more of the following criteria:

- A routine schedule
- Airborne radioactive concentrations
- Hood velocity
- Differential pressure (8-inches of water for negative pressure systems and 4-inches of water for positive pressure systems)
- Particulate penetration

5.2.20 Exhausts from re-circulating process-air cleaning systems either have their HEPA filters penetration tested, or are sampled for airborne radioactive concentrations on at least a quarterly basis. Maintenance is performed on systems found to exceed 25-percent DAC.

5.2.21 The effectiveness of final HEPA filters, in process ventilation equipment and containment systems, is determined by in-situ testing using particulate penetration methods or other means approved by the Radiation Safety Function. The testing is performed following each filter change.

5.2.22 Adequacy of containment and ventilation controls is determined by continuous air sampling. Action levels are approved by the Radiation Safety Function.

**Air Sampling:**

5.2.23 Areas where exposure to airborne radioactive material is a risk are monitored using air sampling.

- Air samplers used to estimate operator Committed Effective Dose Equivalent are located in or around the worker's breathing zone.
- Air samplers used to monitor the effectiveness of containment and/or ventilation are located where they will detect deterioration in these controls.

5.2.24 The breathing zone representativeness for fixed or portable air samplers is:

- Determined in accordance with Section 3 of Regulatory Guide 8.25, "*Air Sampling in the Workplace*."
- Confirmed at least annually or whenever substantive changes are made, in accordance with Section 3 of Regulatory Guide 8.25.

5.2.25 Air samples are changed out on a frequency specified by the Radiation Safety Function.

- Fixed air samplers are typically changed out at least once each working shift during normal operations, unless area airborne concentrations justify a less frequent schedule.
- Samples are allowed time for natural activity to decay and are analyzed on measurement equipment calibrated with sources traceable to national standards.
- Samples suspected of reflecting elevated airborne events are counted as soon as practicable for investigation purposes.
- Lapel samples are used to supplement and/or test fixed samples.

5.2.26 If the radioactivity concentration outside a containment structure exceeds 250-percent DAC for a single sample collected for a minimum of eight hours or if the monthly average for a sample location exceeds 100-percent DAC, special sampling and/or an investigation should be conducted.

5.2.27 All new operations, or substantive modifications to existing equipment are evaluated to assess the need for air sampling.

5.2.28 Air flow measurement devices on air samplers are routinely verified for proper adjustment and proper operation by the Radiation Safety Function.

**Contamination Control:**

5.2.29 Contamination surveys are performed to assure that maximum acceptable limits are not exceeded. Maximum acceptable limits and minimum survey frequencies for floors and other readily accessible surfaces are specified in Figure 5.1.

**Figure 5.1 Contamination Survey Limits and Frequencies**

| AREA TYPE | ALPHA ACTIVITY ON SMEAR * | MINIMUM FREQUENCY |
|---|---|---|
| Change Rooms, and Eating/Vending Areas | 50 | Weekly |
| Clean Area | 200 | Monthly |
| Contamination Control Area | 5000 | Biweekly |

*Units of Disintegrations-Per-Minute Per 100-Square-Centimeters

5.2.30 Approved smear measurement techniques are used to survey floors and other readily accessible surfaces. The following criteria apply to contamination surveys:

- All new operations are subject to increased surveillance.
- Average contamination is based on areas not greater than 10-square meters.
- Decontamination is required within three working shifts whenever the average contamination exceeds the limits.
- Decontamination is required immediately whenever the average contamination exceeds five times the limit.
- Decontamination is required immediately whenever the contamination is found in clean areas.
- Verification surveys are performed to assure decontamination activities are effective (i.e., below limits).
- An alpha smear measurement technique is used, that is capable of detecting 25-disintegrations-per-minute per sample, at a 90-percent confidence level, when surveying clean areas, change rooms, and eating and vending areas.

5.2.31 Specific portions of a Contamination Control Area might be assigned higher limits and/or frequencies, provided a documented evaluation by the Radiation Safety

Function has demonstrated that collective protective measures for the subject area can assure compliance with licensed and regulatory requirements. Examples include areas where contamination does not represent the potential for becoming airborne or being tracked, and areas where decontamination is impractical (e.g., under process equipment, hoods, etc.)

5.2.32 Contamination surveys are performed on radioactive material received from other facilities in compliance with 10CFR20.1906 with the following clarifications:

- The three hour "clock" referenced in 10CFR20.1906, as it applies to the contents of the van, begins when the tamper indicating seal is broken for radioactive material received in an enclosed dry van with a tamper indicating seal.
- For all other receipts of radioactive material, the survey process will be initiated, but not necessarily completed, within the time prescribed by 10CFR20.1906 and continued uninterrupted until completed.

**Access Control:**

5.2.33 Access to areas in which radioactive materials are used or stored is controlled.

5.2.34 Personnel are authorized to work in Contamination Control Areas only after completing required radiation safety training.

5.2.35 Access points to Contamination Control Areas are provided with change rooms and/or step-off pads. Each such access point defines an uncontaminated side and a contaminated side, with the step-off area dividing the two sides.

5.2.36 Each access point to the Contamination Control Area is posted in accordance with 10CFR20.1902, with the exception of 10CFR20.1902(e). In lieu thereof, a sign bearing the legend "Every container or vessel in this area may contain radioactive material" is posted at entrances to each such area in which radioactive materials are used or stored.

5.2.37 Access to Contamination Control Areas, including the Chemical Manufacturing Area and other areas involved in the processing and storage of unencapsulated radioactive material (i.e., not contained in a sealed source, a fuel rod, a shipping container, or other type of strong, tight container), requires the use of protective clothing.

5.2.38 Protective clothing is provided for personnel entering the Contamination Control Area. This includes such apparel as lab coats, coveralls, shoe covers, safety shoes, and/or other specified garments consistent with an individual's work assignment. Street clothing, of persons to be dressed completely in protective clothing, is stored on the uncontaminated side of the change line. Used protective clothing is stored on the contaminated side of the change line until collected for laundering. Contamination limits for protective clothing are consistent with the limits in Figure 5.1.

5.2.39 Personnel survey instruments are provided in change rooms and at step-off pads for use by personnel leaving Contamination Control Areas. The instruments are checked for proper operation at a frequency approved by the Radiation Safety Function.

5.2.40 Instructions are posted at exit points from Contamination Control Areas, which describe survey techniques, procedures for decontamination, and what to do in the event of survey instrument malfunction.

5.2.41 Personnel contamination levels which exceed administrative limits will be entered into the CAP.

**External Exposure:**

5.2.42 Adults likely to receive greater than 0.5 rem in a year, from sources external to the body, are monitored by personnel dosimeters.

5.2.43 Personnel dosimeters, supplied by a NVLAP-certified commercial supplier, are issued to trained users to measure external exposure to beta, gamma and x-rays.

5.2.44 Neutron detection capability is maintained and evaluated at least quarterly.

5.2.45 Personnel dosimeters are evaluated on a frequency, not greater than quarterly, specified by the Radiation Safety Function.

**Internal Exposure:**

5.2.46 Adults likely to receive greater than 10-percent of the applicable ALI values, are monitored for intakes of radioactive material.

5.2.47 Intakes of radioactive material are determined by measuring airborne radioactivity concentrations via air sampling in the work area, by measuring the radionuclides in the body, and/or by measuring the radionuclides excreted from the body.

- The primary method of determining Committed Effective Dose Equivalent (CEDE) is by measuring the airborne radioactivity concentration via air sampling.
- In-vitro samples, collected during work restrictions, may be used to determine CEDE in place of air sampling results.

5.2.48 Work restrictions and diagnostic evaluations are initiated when air sample results indicate an individual may have received a single significant intake of:

- Greater than 40 DAC-Hours exposure to non-transportable compounds of uranium.

- Greater than 20 DAC-Hours exposure to transportable compounds of uranium.

5.2.49 Work restrictions without diagnostic evaluations are imposed when individuals exceed administrative limits or 80% of applicable annual limits (i.e., 0.8 ALI, 1600 DAC-Hours, 4.0 rem CEDE, 4.0 rem TEDE, 4.0 rem DDE, 40 rem CDE, etc.)

5.2.50 Diagnostic evaluations include in-vitro and in-vivo analyses to support air sampling measurements in determining CEDE and to demonstrate compliance with occupational dose equivalent limits in 10CFR20.

5.2.51 A bioassay capability is maintained to evaluate the effectiveness of contamination control and personnel protection practices, to evaluate intakes of radioactive material that exceed action levels in Section 5.2.48 of this Chapter, and to determine compliance with applicable occupational dose equivalent limits.

- The bioassay program conforms to guidance provided in Regulatory Guide 8.9.
- Routine in-vitro bioassay samples (urinalysis) are collected and evaluated, at least annually, to track and evaluate retention of radioactive material in individuals.
- Routine in-vivo bioassay (lung burden) is performed, at least annually, to track and evaluate retention of radioactive material in individuals. In-vitro analysis is used in place of lung burden measurements for claustrophobic individuals.
- Initial baseline and termination bioassay evaluations are performed when practical.

**Calculating Total Dose:**

5.2.52 Internal and external occupational radiation doses are combined in accordance with criteria in 10CFR20; and, applicable guidance contained in Regulatory Guide 8.7, "Instructions for Recording and Reporting Occupational Radiation Exposure Data" and in Regulatory Guide 8.34, "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses."

5.2.53 Radiation dose to the embryo/fetus is calculated in accordance with applicable guidance in Regulatory Guide 8.36, "Radiation Dose to the Embryo/Fetus."

5.2.54 Exposures or doses which exceed administrative limits or the dose limits in 10CFR20 Appendix B or 10CFR70.61 will be entered into the CAP as described in Section 3.8 of this License Application.

**Respiratory Protection:**

5.2.55 When engineered and/or administrative controls are not practical for protecting individuals from intakes of radioactive material, respiratory protection is provided for use in accordance with an approved policy statement specified by the Radiation Safety Function.

5.2.56 Respiratory protection equipment is used in accordance with written procedures which cover:

- Respirator selection, fitting, issuance, maintenance and testing.
- Supervision and training of personnel.
- Monitoring, including air sampling and bioassay.
- Recordkeeping.
- Use of process or other engineering controls, instead of respirators.
- Routine, non-routine and emergency use of respirators.
- Periods of respirator use, and relief from respirator use.

5.2.57 The respirator protection policy includes the following elements.

- Only respiratory devices certified by the National Institute for Occupational Safety and Health / Mine Safety and Health Administration (NIOSH/MSHA) are used.
- Individuals using respiratory protection are trained in accordance with the criteria in 10CFR20, Subpart H.
- Respiratory protection factors from 10CFR20, Appendix A, or more conservative protection factors based on the results of quantitative fit tests, are used when assigning actual radioactive material intakes to individuals.
- Personnel authorized to use respiratory protection equipment are fit-tested annually.
- Personnel authorized to use respiratory protection equipment are trained in the applicable requirements biennially.
- Determination is performed by a physician prior to the initial fitting of respirators, and periodically at a frequency determined

by a physician, that the individual user is medically fit to use the respiratory protection equipment. In lieu of a physician, this determination may be made by a nurse practitioner under the supervision of a physician.

- Personnel are required to test respirators for operability immediately prior to each use.

**Instrumentation:**

5.2.58 Instruments used for radiation safety measurements have capabilities to cover the range of use as follows; however, more than one instrument might need to be utilized to cover the specified range:

(a) Portable Survey Instruments:

- Alpha: 100 to 1.0E06 disintegrations per minute;
- Beta-Gamma: 0.1 millirem per hour to 300 rem per hour;
- Neutron: 0.5 to 5 millirem per hour.

(b) Laboratory Assay Instruments:

- Alpha: 10-percent DAC values for sampling periods of 8-hours or more.

5.2.59 Radiation safety instruments are calibrated on a routine schedule established by the Radiation Safety Function. The schedule requires calibration:

- Following initial instrument acquisition,
- Following major repairs, and
- At least annually.

5.2.60 Alpha counting instruments used in the Radiation Safety Laboratory are checked each working day, when in use, to determine:

- Background activity, and
- Statistical Control using a certified source.

5.2.61 Instrument calibration records are maintained for a period of at least three years.

5.2.62 Operability of portable survey instruments is determined prior to use.

**Radiation Safety Analysis:**

5.2.63 The Radiation Safety Analysis is a comprehensive assessment, which identifies controls required to maintain an adequate margin of safety.

5.2.64 The Radiation Safety Analysis consists of individual radiological accident sequences analyzed using the accident flow diagram method. The sequence is traced through the event to arrive at a consequence of interest. Each identified pathway defines an initiating event and protective measure failures that collectively represent an accident sequence.

5.2.65 The Radiation Safety Analysis is one of the evaluation methods of the ISA process described in Chapter 4.0 of this License Application. The level of detail for a particular analysis is based on the complexity of the initial system and of subsequent proposed changes to the system. Thus, the scope and content of a Radiation Safety Analysis are customized to reflect the particular characteristics and needs of the specific system.

5.2.66 Radiation Safety Analysis is maintained current through implementation of the Configuration Management program described in Sections 3.1 and 4.1 of this License Application. Subsequent changes that might affect the Baseline ISA are reviewed by the Radiation Safety Function. If Radiation Safety Analysis is required for a proposed change, it is performed to current standards.

**Audits:**

5.2.67 Audits are conducted to compare established Radiation Safety standards to CFFF performance. These audits are performed in accordance with the requirements in Section 3.6 of this License Application.

- The complete Radiation Safety Program is audited on a triennial frequency.
- The CFFF ISA is audited on a five year frequency.
- Results of the audits are documented, and findings are put into the CAP and maintained for NRC Staff review and inspection.

# CHAPTER 6.0

# NUCLEAR CRITICALITY SAFETY (NCS) PROGRAM

## 6.1 NCS PROGRAM STRUCTURE

The CFFF maintains a NCS Program for the site. A primary purpose of the NCS Program is to designate the controls and barriers that are relied upon to prevent criticality in operations with SNM. The NCS Program meets the requirements of ANSI/ANS-8.1 (2014) and ANSI/ANS-8.19(2005). Also, CFFF is committed to following the requirements of ANSI/ANS-8.23(1997) with regards to emergency response as pertaining to NCS to assure personnel are protected from the consequences of a criticality accident.

All activities that may affect NCS shall be performed in accordance with written and approved procedures. Should no specific procedure exist applicable to the situation, work shall not be initiated until such time that NCS staff has evaluated the situation and provided guidance. Furthermore, CFFF personnel shall report any defective NCS conditions to the NCS staff.

### 6.1.1 General Control Program Practices

The Double Contingency Principle of ANSI/ANS-8.1(2014) is the basis for design and operation of processes using SNM within the CFFF. Double Contingency Protection means that all process designs incorporate sufficient margins of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible. The preferred approach to demonstrate double contingency is to control two independent parameters. In those instances where multiple controls are used to prevent changes in a single parameter (e.g., mass, moderation, or geometry) and Double Contingency Protection exists by way of multiple process upsets before a criticality accident is possible, sufficient redundancy and diversity of controls are used to assure that at least two process upsets remain independent. The use of a single NCS control to maintain the values of two or more controlled parameters constitutes only one component necessary to meet double contingency protection.

For each process within a system, a defense of one or more controlled parameters is employed and is documented within the process Criticality Safety Evaluation (CSE). The defense consists of the bounding assumptions, criticality safety limits, and controls that, as a set, are sufficient to maintain subcriticality during normal and credible abnormal conditions.

CSEs are performed to identify the specific limits and controls necessary for the safe and effective operation of a process. Types of NCS controls and their relative preference for use are described in Section 6.1.2 of this Chapter. The NCS controls are included as part of the process design criteria. Passive engineered controls are verified at time of installation and, where appropriate, are entered into the management measures programs for routine inspection and maintenance to assure their reliability and availability. Active

engineered controls undergo an operational verification process prior to first use in any system, to assure reliability of intended function, and are entered into the management measures programs for routine testing and maintenance to assure continued availability. Periodic inspection of passive controls, and testing of active controls, is implemented through approved procedures. Any instrumentation relied upon to either verify or impose an NCS control or parameter is subject to CFFF management measures programs to assure the reliability of its intended function. Any such controls that are not functionally tested or replaced on a regular schedule are specifically identified, and the reason for not testing or routinely replacing is documented. Administrative controls are implemented through approved procedures. The reliability and effectiveness of administrative controls are assured through management measures that include procedure reviews, training, and audits/assessments.

### 6.1.2 Control Methods

The effectiveness and reliability of NCS controls are considered, justified, and documented in the CSE process. Passive engineered controls are preferred over other types of controls, and are used whenever practicable (i.e., when such controls can be implemented, would not cause excessive restriction of operations, and are not cost-prohibitive when compared to their benefits). Active engineered controls are the next preferred method of control. Administrative controls are the least preferred method of control; and, their use is limited to process systems which, in the judgment of the NCS Function, do not provide sufficient benefit for the cost that would be associated with any potential engineered controls. The choice of a particular control will be justified in the appropriate CSE identifying the control. Use of active engineered controls and administrative controls (as opposed to passive engineered controls) will be justified similarly.

(a) Passive Engineered Controls

These are controls that require no operator action or other response to be effective when used to assure NCS. Examples of such controls are favorable geometry equipment and moderation control water barriers.

(b) Active Engineered Controls

These are controls that use a sensed signal or condition to automatically initiate effective actions when called upon to assure NCS. An example of such a control is a shutoff valve actuated by an inline detector signal.

(c) Administrative Controls

These are controls that rely on an operator to perform effective actions to assure NCS. Examples of administrative controls are: actions taken in accordance with a written procedure, verification of information with the assistance of a computer terminal, and actions taken in response to an alarm.

### 6.1.3 Controlled Parameters

NCS is achieved by controlling one or more parameters of a system within subcritical limits, with sufficient factors of safety, in conformance with the Double Contingency Principle. Specific controlled parameters that are considered during the CSE process are described below. The following apply to each parameter:

(a) The CSE process is used to identify the significant parameters affected within a particular system.

(b) For each parameter, the optimum (i.e., most reactive) condition for each parameter is assumed, unless 1) it is demonstrated that less reactive conditions are the worst case credible conditions, or 2) appropriate controls (IROFS) are established to maintain the parameter within the assumed limits.

(c) All assumptions relating to process / equipment / material theory, function, and operation (including credible upset conditions) are justified, documented, and independently reviewed by the Technical Review described in Section 6.1.6. Furthermore, independent review of the assumptions, including the basis or rationale for their acceptance, is separately documented at least every three years. In addition, the most reactive credible dimensional and material composition tolerances are assumed.

Details of the various CFFF systems and their parametric controls are described in the CFFF ISA. IROFS used to control NCS parameters are listed in the ISA Summary provided for each system. This listing provides the type (passive, active, or administrative) of control, the control's function, and key management measures (e.g., maintenance, procedures, etc.) applied to each control.

#### 6.1.3.1 Mass

(1) Mass control is used to limit the quantity of uranium within specific process operations or vessels; within storage, transportation, and disposal containers; and within a room or groups of rooms. Mass control is used both on its own and in combination with other parametric controls. When mass limits are derived based on weight percent of uranium, compliance is verified by either weighing the material and ascribing the entire mass to uranium, or conducting physical measurements to establish the actual weight percent. Furthermore, process variables that can affect the weight percent of uranium are identified as controls.

(2) An evaluation to establish mass limits involves consideration of all appropriate criticality safety parameters and is documented accordingly. The evaluation also considers normal operations and expected process

upsets to determine the operating mass limit and the controls necessary to maintain subcriticality. When only administrative controls are used for mass-controlled systems, double batching is generally assumed to be the worst credible single-upset condition, but this must still be justified in the appropriate CSE. Analytical or non-destructive measurement methods are employed to determine the mass of a specific quantity of material.

(3) Whenever mass control is established for a room or group of rooms, detailed records are maintained to document mass transfers into and out of the rooms.

(4) When using a single parameter mass limit derived from experimental data, the mass is limited to no more than 45% of the mass limit when double-batching is credible, and no more than 75% of the mass limit when double-batching is not credible.

(5) For operations involving SNM, material is treated conservatively as having a high content of uranium until demonstrated otherwise.

### 6.1.3.2 Moderation

(1) Moderation control is used both on its own and in combination with other parametric controls.

(2) Moderation control includes those controls required to exclude moderator from a system, those controls required to restrict the amount of moderator in a system, and/or those controls required to detect the presence of moderator in a system.

(3) Moderation controls (IROFS) are established to assure that the interstitial moderator or the water between fissile units, is maintained within the analyzed system's documented limits, for normal operation and expected process upsets. The most reactive credible "full range" densities (i.e., humidity/mist conditions to full water density) for interstitial moderator are modeled.

(4) When moderation control is used as the sole controlled parameter, the operations are conducted in a "Moderator Control Area," and the requirements of ANSI/ANS-8.22(1997) are used. In addition, the following requirements are applied:

- Minimum protection requires that two independent barriers (e.g., roofs) must fail before moderation control can be compromised. Management measures to maintain the barrier, including routine inspections, are

required. All outermost barriers are tested for leakage as part of initial barrier installation.

- Procedures are established to control the introduction of moderating materials to, and use of moderating materials in, areas under moderation control Procedures are established to assure removal of all uncontrolled or unauthorized moderator prior to releasing a moderation controlled system for production. Procedures are established to prevent uncontrolled or unauthorized moderator from entering the system after SNM loading (e.g., into a bulk container) has occurred.

- Two independent measurements (i.e., two separate samples measured on two different instruments, or on the same instrument but separated by a standard control check), and/or two independent samples (i.e., two samples taken by two different people at different times using different sampling methods), are used to establish material moderator content. The process for sample collection, preparation, analysis, and posting of results is designed to assure the results obtained are independent.

- Procedures are established for transportation of moderation controlled materials outside of Moderator Control Areas. The basis for selection of route barriers, to prevent accidental exposure to moderators, is documented within the applicable CSEs. Management measures to maintain the route barriers, particularly routine inspections, are required.

(5) When moderation control is used in addition to one or more other controlled parameters, the requirements of ANSI/ANS-8.22(1997) are used, with one exception: a "Moderator Control Area" is not formally designated, in order to avoid diluting the significance of the designation, with respect to processes that rely only on moderation control.

### 6.1.3.3 Concentration

(1) Concentration control is used both on its own and in combination with other parametric controls.

(2) Concentration controls established to maintain a system within documented limits are evaluated in a CSE and shown to be reliable and independent.

(3) The determination of concentration limits and controls considers all physical and chemical mechanisms that can affect concentration such as precipitation, evaporation, freezing, settling, heterogeneity and chemical phase change events as appropriate.

(4) When determining concentration, and concentration is the only controlled parameter, two independent controls/measurements, or the analysis of two independent samples (taken by two different people or instruments), are used. As required by the implementing CSE, sample analysis or measurement are performed by two different instruments, or by the same instrument separated by a standard control check.

(5) As required by the implementing CSE, in cases where the system design of a process tank using concentration-controlled solution does not preclude an inadvertent addition of precipitating agents, the tank will be closed and locked to prevent unauthorized access.

### 6.1.3.4 Geometry / Volume

(1) Geometry control is used to limit the shape, or volume of SNM within specific process operations and vessels; and, within storage transportation, and disposal containers. Geometry control is used both on its own and in combination with other parametric controls.

(2) Definitions for achievement of geometry control:

- Favorable geometry means establishing the characteristic dimensions of importance for a single unit of a specified shape such that criticality safety is maintained in conjunction with one or more other constraints (e.g., material form, material concentration, reflection, enrichment, etc.). At the CFFF, the other parameter constrained is often enrichment. Since enrichment is maintained at or below the maximum licensed enrichment for CFFF, such favorable geometry dimensions are considered the equivalent of safe geometry dimensions.

- Safe geometry means establishing the characteristic dimensions of importance for a single unit such that criticality safety is maintained without any other constraints.

- Level control means detecting (e.g., through use of level probes) or removing (e.g., through use of overflow holes or slots) material in/from a non-favorable geometry vessel at a specific level, such that material accumulation within the vessel is limited to a favorable height. When level is credited as a controlled parameter, appropriate analyses are performed to demonstrate the adequacy of the controls.

(3) Geometry controlled systems are analyzed and evaluated for fabrication tolerances and dimensional changes that might occur through corrosion, wear, or mechanical distortion.

(4) When using critical dimension limits derived from experimental data, the margins of safety are no more than 90% of the critical cylinder diameter, 85% of the minimum critical slab thickness, and 75% of the minimum critical sphere volume.

(5) Geometry controls are maintained through management measures that include procedure reviews, training, and audits/assessments. Where appropriate, passive geometry controls are entered into the management measures programs for routine inspection and maintenance to assure their reliability and availability.

### 6.1.3.5 Material Composition and Process Characteristics

(1) Within specific manufacturing operations, credit is taken for physical and chemical properties of the process, and/or materials in the process, as NCS controls.

(2) When credit is taken for process characteristics (e.g., the physical and chemical properties of a process and/or process materials), the bounding assumptions and limits are documented and justified in the applicable CSE.

(3) Utilization of process and/or material characteristics as controls is based on known scientific principles, established physical properties or chemical reactions, in conjunction with experimental data supported by CFFF operational history.

(4) The applicable CSE for each system documents the effects of material composition within the process being evaluated and documents the basis for composition selection in subsequent system modeling for analysis.

### 6.1.3.6 Enrichment

(1) Enrichment control is used in combination with all other parametric control methods.

(2) Control of enrichment to not exceed the licensed limit is used to limit the percent of U-235 in a process, vessel, or container. Active engineered and/or administrative controls are required to verify enrichment, and to prevent the introduction of uranium at unacceptable enrichments, within the defined system.

### 6.1.3.7 Heterogeneity

(1) When applicable, significant effects of material heterogeneity within a system are documented within the applicable CSE.

(2) NCS calculations have demonstrated that for particle sizes $\leq$ 150 microns in diameter, the material can be considered homogeneous.

(3) For particle sizes greater than 150 microns in diameter, an evaluation takes into account the effects of heterogeneity specific to the process being analyzed.

### 6.1.3.8 Neutron Absorbers

(1) Neutron absorbing materials (aka "poisons") are used to provide NCS control for processes, vessels, and containers. When so used, the absorbers are solid (i.e., fixed) materials (e.g., borosilicate-glass Raschig rings, gadolinium plates, borated stainless steel, etc.) or solution (e.g., boric acid with a minimum concentration to assure adequate subcriticality).

(2) When Raschig rings are used, their use and maintenance is in accordance with ANSI/ANS-8.5(1996). To prevent the degradation of the Raschig rings during use in basic environments/solutions, the chemical and physical limits are as follows:

- System pH is maintained $\geq$ 7, but $\leq$ 11.
- System temperature is maintained $\leq$ 60 degrees (Celsius).
- The condition of the Raschig rings in the operational Q-Tanks is verified annually.

(3) For fixed absorbers other than Raschig rings, in addition to the requirements of ANSI/ANS-8.21(1995), the following requirements apply:

- The absorber dimension and composition are measured, and documented in the applicable CSE, prior to first use.

- The presence and condition of the absorber in the process, vessel, or container is verified on a frequency documented in the applicable CSE. Methods of verification include traceability (e.g., unique serial number), visual inspection, and/or specific measurements.

### 6.1.3.9 Reflection

Credible reflection conditions are considered in the determination of all system limits and controls. The terms "full reflection" and "partial reflection" are defined as 12-inches and 1-inch of water equivalent (tight-fitting), respectively. If reflecting materials other than water are present (e.g., concrete), their reflecting properties are evaluated for all credible conditions and justified, as appropriate. When less than full reflection is assumed, it is demonstrated that the reflection conditions modeled are the most reactive credible conditions; otherwise appropriate controls (i.e., IROFS) are established to maintain reflection within the applicable limits.

### 6.1.3.10 Interaction / Spacing

NCS analyses consider the potential effects of interaction. The following general guidance is utilized in the evaluation:

- Units may be considered non-interacting when they are:
  - separated by 12 inches of full density water equivalent material; or
  - separated by a distance in air which is the larger of 12 feet, or the greatest distance across an orthogonal projection of the largest fissile accumulations on a plane perpendicular to the line joining their centers
- The interaction of units not meeting the above criteria are evaluated using approved and validated methods. This includes calculations with validated computer codes (XSDRN, KENO, MCNP, etc.), standards (ANS-8 series limits) and approved hand calculation methods.

To maintain physical separation between units, engineered controls are used. If engineered controls are not feasible, administrative controls with visual aids such as painted lines and postings may be used. However, multiple procedural errors should not by themselves lead to criticality. The structural integrity of the engineered controls (e.g., spacers or racks) is sufficient for normal and credible abnormal conditions. Spacing controls are maintained through management measures that include procedure reviews, training, and audits/assessments. Where appropriate, passive spacing controls are entered into the management measures programs for routine inspection and maintenance to assure their reliability and availability.

### 6.1.3.11 Density

Density is not relied upon as a controlled parameter. As concentration is a controlled parameter, density is only an implicit controlled parameter.

### 6.1.4 Criticality Safety Documentation

#### 6.1.4.1 Criticality Safety Calculation Notes (Calc Notes)

(1) Calc notes may be used to document criticality safety computer and hand calculations.

(2) Calc notes can be referenced in CSEs.

(3) Calc notes can be used to document parametric studies that may be referenced by multiple CSEs.

#### 6.1.4.2 Criticality Safety Evaluation (CSE)

(1) The CSE is a comprehensive NCS evaluation of each component within a defined system. The evaluation identifies controlled parameters for the system, establishes bounding assumptions for other system parameters, and identifies the controls necessary to maintain subcriticality. In addition, the basis for bounding assumptions for other system parameters are documented and justified. Calculations and sensitivity studies are performed as necessary to identify the margin of subcriticality.

(2) The CSE serves as the primary documentation that Double Contingency Protection exists for the system, when controls are applied to the parameters that prevent each contingency from occurring.

(3) In the CSE, the reliability of each control is evaluated, and potential common mode failures are considered. Margin of safety is also addressed.

(4) As part of the CSE process, criticality accident sequences are evaluated by teams of process, operations and criticality safety experts. These accident sequence evaluations are documented in the CSE and serve as input to the ISA fault trees that are used to demonstrate that each accident sequence is highly unlikely to occur.

(5) As part of the CSE process, the accident sequences are classified as incredible events, anticipated process upsets, or credible abnormal configurations.

(6) Justification is provided for the classification of the accident sequence as a credible abnormal configuration based on one of the following attributes:

- requires multiple independent process upsets or control failures before the condition could occur (multiple failures of the same parameter or multiple parameters failed in the same model); or
- value of one or more failed/uncontrolled parameters exceeds what is physically credible; or

- condition includes at least one parameter that is evaluated at conditions more reactive than at normal operations, but one or more of the other parameters has failed (loss of a contingency).

This justification shall demonstrate conservatism and may be based on either a parametric study or other documented technical basis (e.g., historical data that forms the basis of an assumption). Conditions not meeting the above criteria shall be evaluated as normal conditions, or anticipated process upsets or incredible events.

(7) CSEs are performed by qualified NCS staff in accordance with guidelines provided in the CFFF procedure for CSE generation.

(8) CSEs must be reviewed by a qualified Criticality Safety Technical Reviewer (see Section 6.1.6 of this Chapter), and must be approved by Criticality Safety management and appropriate plant operations management, or designates.

(9) CSEs serve as the "living" documentation of the plant criticality safety basis and, as such, are maintained current through implementation of the CFFF Configuration Management program.

(10) "Record" copies of CSEs must be maintained in accordance with CFFF document control requirements.

### 6.1.5 Analytical Methods

Validated computation methods are used to calculate the $k_{EFF}$ of individual pieces of equipment, and to calculate equipment interactions. Conditions evaluated include normal operations, anticipated process upsets, and credible abnormal operations. When using nationally-accepted standards or handbook data, appropriate margins are employed as dictated by the requirements of the process. If the data is not from a nationally-recognized source, appropriate validation of the data is performed before it is employed in a CSE.

#### 6.1.5.1 Analytical Codes

Criticality safety calculations are performed using the approved and validated computer codes such as SCALE, MCNP, XSDRN, etc.

#### 6.1.5.2 Limits of $k_{EFF}$

Based on the results of calculations, the sensitivity of key parameters are evaluated to determine the effect on $k_{EFF}$, and to assure that adequate controls have been provided to demonstrate a sufficient margin of safety for the analyzed system.

(1) For normal operations and anticipated process upsets, a sufficient margin of safety is defined as a 95/95 $k_{EFF}$ that is $\leq 0.95$ when all applicable biases and computational uncertainties are taken into account.

(2) For credible abnormal configurations, a sufficient margin of safety is defined as a 95/95 $k_{EFF}$ that is $\leq 0.98$ when all applicable biases and computational uncertainties are taken into account.

(3) A 95/95 $k_{EFF}$ that includes all applicable biases and computational uncertainties is demonstrated using the following equation:

$$95/95\ k_{EFF} = k_s + 2\sigma_s + (\text{bias} + \text{uncertainty})$$

where:

$k_s$ is the calculated multiplication factor, using a validated computation method; $\sigma_s$ is the $k_s$ standard deviation for that computation method; and,

(bias + uncertainty) is the appropriate value from the validation performed for that computation method, determined as described in Section 6.1.5.3 of this Chapter. Note that a negative bias is not credited (i.e., a bias that reduces the value of the calculated $k_{EFF}$).

(4) Several types of completed fuel assemblies are designed to exceed a 95/95 $k_{EFF}$ of 0.95, and as such Section 6.1.5.2 (1) requirement above does not apply to analyses of completed fuel assemblies in the Final Assembly Wash Pit, as long as:

- the assemblies are modeled explicitly and demonstrated to result in 95/95 $k_{EFF} \leq 0.98$ for credible abnormal configurations when all applicable biases and computational uncertainties are taken into account; and,

- bounding assembly design criteria and appropriate manufacturing tolerances are accounted for in the analyses of the fuel assemblies.

(5) Section 6.1.5.2(4) of this Chapter, for completed fuel assemblies in the Final Assembly Wash Pit, shall only apply to those fuel assemblies authorized in that area as of February 29, 2008; or to future fuel assembly designs meeting the following criteria:

- Fuel assembly calculations are performed using the same conservative assumptions (enrichment of 5 w/o U-235, full theoretical $UO_2$ density, the neglect of neutron absorbers and structural materials, fully flooded and reflected by water) as used for existing fuel designs; and either
- The fuel assembly is demonstrated to be bounded by an existing fuel assembly design; or
- The fuel assembly calculations are within the area of applicability of a validation used for an existing fuel assembly design (without requiring an extension to the area of applicability).

If the new fuel design requires a new validation, or an extension to the area of applicability of an existing validation, the licensee shall submit, along with the validation report a demonstration that the validation covers the new fuel calculations.

Future fuel designs not meeting this condition shall be subject to a 95/95 $k_{EFF}$ of 0.95 for normal conditions.

### 6.1.5.3 Validation Techniques

Computational methods are validated in accordance with requirements of ANSI/ANS-8.1(2014). Validations completed before 2007 may include nationally-recognized methods such as those documented in NUREG/CR–6361 "*Criticality Benchmark Guide for Light Water Reactor Fuel in Transportation and Storage Packages*" or NUREG/CR-6698 "*Guide for Validation of Nuclear Criticality Safety Calculational Methodology*." Validations performed after June 27, 2007 shall comply with the requirements of ANSI/ANS-8.24(2007) except where modified by specific License Application commitments.

Validation reports are prepared, reviewed, and approved by qualified individuals for each combination of computational method (e.g., code), cross-section library, computer platform, and analytical area of applicability (e.g., homogenous $UO_2$ versus heterogeneous $UO_2$), as appropriate. In all cases, each validation report, or the calculation note documenting an analysis using a specific computational method, shall include the following:

(1) Demonstration of the adequacy of the margin of safety for subcriticality by assuring that the margin is large compared to the uncertainty in the calculated value of $k_{EFF;}$

(2) Demonstration that the calculation of $k_{EFF}$ is based on a set of variables whose values lie in a range for which the methodology used to determine $k_{EFF}$ has been validated; or demonstration that trends in the bias support the extension of the methodology to areas outside the areas of applicability;

(3) A description of the specific validation method used, including reference to input data, area of applicability, and discussion of the applicable uncertainties; and

(4) A description of data outliers rejected shall be based on inconsistency of the data with known physical behavior, and not on statistical rejection methods alone.

The validation report documented in LTR-EHS-05-146, Revision 2, "*Validation of the CSAS25 Sequence in SCALE-4.4 and the 238-Group ENDF/B-V Cross Section Library for Homogeneous Systems at the Westinghouse Columbia Fuel Fabrication Facility*" demonstrates a practical example of the validation methodology used, and all future validations are performed in a similar manner to comply with this methodology.

New or revised NCS related validation reports that are applicable to the Westinghouse CFFF are submitted to the NRC staff for review by the end of the next calendar quarter following issuance of the new or revised validation report.

### 6.1.5.4 Computer Hardware and Software Control

(1) Validation and verification are completed, documented and independently reviewed before:

- Use of specific hardware and software systems utilizing specific cross section libraries;
- Use of analytical codes;
- Use of the methodology; and,
- Qualification and re-qualification of the codes.

(2) The configuration of the hardware platform used in support of software for criticality safety calculations is maintained such that only authorized system administrators are allowed to make system changes. System changes are conducted in accordance with an approved configuration control program that addresses both hardware and software qualification. System operability verification is used for alerting users to any changes that might impact the operation of codes on the platform.

(3) Software on the platform that is designated for use in criticality safety calculations is compiled into working code versions, with executable files that are traceable with respect to length, time, and version.

(4) Modifications to hardware or software that are essential to the calculation process are followed by code operability verification. In such cases, selected calculations are performed to verify results are not substantially different to those from pre-modification analyses. Any deviations disclosed by code verification, that might alter the bias or uncertainty; require re-qualification of the code prior to continued use.

### 6.1.6 Technical Review

A qualified NCS technical reviewer (TR) performs an independent verification of all criticality safety evaluations and calculations that support limits specified in a safety analysis. The TR verifies that a proposed calculation geometry model and configuration adequately represents the system being analyzed. The TR verifies that proposed material characterizations (e.g., density, concentration, etc.) adequately represent the system. The TR also validates any assumptions used in the evaluation as per Sections 6.1.3(b) and

6.1.3(c) of this chapter and documents the basis for their acceptance. The minimum required qualification for a TR is identified in appropriate CFFF procedures.

The verification of such evaluations and calculations uses one (or more) of the following processes:

(1) Verification using an alternate computer code and/or hand calculations.

(2) Verification by performing a comparison with prior results for a similar, approved calculation and/or a similar configuration.

(3) Verification by performing a technical verification, including checks of the computer code used, and evaluation of code input and output.

(4) Verification using a custom method, including detailed information that describes the custom methodology.

### 6.1.7 Posting of Limits and Controls

Distinctive NCS postings shall be in areas, operations, work stations, and storage locations relying on administrative controls as required by the implementing CSE. Posting includes placement of signs and/or physical identification (e.g., using tape, paint, etc.) of floors, to designate approved work and storage areas. Postings provide information and/or specific precautions to supplement operating procedures.

Appropriate postings are placed at the entrance to work and holding areas (e.g., equipment, rooms, etc.) where fissile material is processed or stored. Criticality safety precautions or prohibitions (e.g., approved moderator limits, approved fire-fighting methods, etc.) are posted at entrances to affected areas. Storage postings are conspicuously located at entrances to holding areas (i.e., at such locations that it would be unlikely that personnel could enter an area without seeing the postings); and, include (as applicable) information such as material type, container identification, number of containers allowed, controlled parameter limits, and spacing requirements.

Postings are approved and issued by the NCS Function. First level managers are responsible for assuring that their cognizant personnel are aware of, and understand, posted information.

### 6.1.8 Criticality Accident Alarm System (CAAS)

The CFFF is committed to following the requirements of ANSI/ANS-8.3(1997). The CAAS initiates immediate evacuation of the facility in response to detection of a potential

criticality accident. The CAAS, and the proper response protocol, is detailed in the CFFF Emergency Plan and Emergency Procedures.

The CAAS radiation monitoring detectors are located in accordance with the requirements of ANSI/ANS-8.3(1997) (as modified by Regulatory Guide 3.71, Revision 2), and compliance with 10CFR70.24. Location and spacing of the detectors are chosen to minimize the effect of shielding by massive equipment or materials of construction. Spacing is reduced where high-density materials (e.g., concrete, cinder block, brick, etc.) are located between a potential accident source and a detector. Low-density materials (e.g., wooden construction walls, non-load walls, office panel walls, metal-corrugated panels, doors, plaster, etc.) are disregarded when determining CAAS spacing. The CAAS is designed to remain operational during credible events.

If the CAAS is out-of-service, within one hour the CFFF will suspend movement and processing of fissile material in the coverage area until the process is brought to a safe shutdown condition. Movement of fissile material necessary to establish or maintain a safe shutdown condition may continue. Movement and processing of fissile material will not resume unless the CAAS is returned to service, or continuously attended portable detection instruments, capable of detection and alarm, are provided to monitor the area normally covered by the installed CAAS. These actions will be directed and enforced by the plant emergency response team. The portable detection and alarm devices shall be of a type pre-approved for this use by the NCS Function. Once the installed CAAS is returned to service, the monitoring provided by the portable devices may be discontinued. Routine testing, calibration, and/or maintenance of the CAAS for up to four hours is permitted without suspension of fissile material movement or processing.

Employees and visitors are trained in responding to the alarm signal, which is a continuous warbling siren. An ongoing aspect of this training is a quarterly test of the signal on all working shifts. The CAAS is clearly audible in all areas to be evacuated to assure timely notification and evacuation or provide alternative notification methods documented effective in notifying personnel that evacuation is necessary. Furthermore, areas where CAAS is deployed, CFFF provides fixed and personnel accident dosimeters for responding emergency personnel. Prompt onsite dosimeter readout is available in a location outside the immediate evacuation zone to protect response personnel from the consequences of a nuclear criticality accident.

### 6.1.9 Audits and Assessments

Audits and assessments are conducted to compare established NCS standards to CFFF performance. These audits and assessments address the requirements of ANSI/ANS-8.19(2005) and are performed as described in Section 3.6 of this License Application.

- The complete NCS Program is audited on a triennial frequency. This audit shall include an effectiveness review of the CSE technical review process.

- The CFFF ISA is audited on a five year frequency.

- Results of the audits are documented, and findings are put into the CAP and maintained for NRC Staff review and inspection

Facility walkthrough assessments are conducted for each of the fissile material processing areas described in the ISA. These assessments are performed by the NCS Function with a focus on field compliance with established NCS controls. These assessments are based on the criticality safety risk defined in the ISA and are performed so that the complete set of operations making up the CFFF ISA are assessed on a quarterly (higher risk) or semiannual (lower risk) frequency. Results of the assessments are documented and maintained for NRC Staff review and inspection.

### 6.1.10 Procedures, Training, and Qualification

At the CFFF, procedures, training and qualification are integrated into a combined process to assure that safety and safeguards activities are being conducted by trained and qualified individuals, in accordance with approved policies and in accordance with commitments to Regulatory Agencies. This process is described in Section 3.4 of this License Application, and meets the requirements of ANSI/ANS-8.19(2005) and ANSI/ANS-8.20(1991), as they relate to training, procedures, and the requirement that no single, inadvertent departure from a procedure could cause an inadvertent criticality.

# CHAPTER 7.0

# CHEMICAL SAFETY PROGRAM

## 7.1 CHEMICAL SAFETY PROGRAM STRUCTURE

The CFFF maintains a Chemical Safety Program for the site which provides adequate protection against chemical hazards pertaining to the storage, handling and processing of licensed materials. A primary purpose of the Chemical Safety Program is to assure that workers, the public and the environment are adequately protected from the chemical hazards of licensed materials. Chemical safety is also an element of the ISA program described in Chapter 4.0 of this License Application. CFFF chemical safety commitments pertaining to compliance with 10CFR70 Subpart H requirements, including Process Descriptions, Process Theory, Accident Sequences, Accident Consequences and IROFS are described in Chapter 4.0 of this License Application. The programmatic elements discussed in this Chapter are applicable to normal and abnormal operations.

### 7.1.1 Program Basis

7.1.1.1 Chemical Safety Program activities are implemented through approved procedures at the CFFF. Equipment and facilities important to the chemical safety of licensed materials and to protect health and minimize danger to life or property are described in detail in the CFFF ISA and ISA Summary.

7.1.1.2 Other key elements of the Chemical Safety Program include the following attributes:

- The CFFF commits to having written procedures defining the Authority and Responsibility for Safety. This authority and responsibility applies to Westinghouse Management, Westinghouse employees, Contractor employees, Visitors, Customer representatives and Regulatory personnel.
- A Hazard Communication Program is implemented to assure that hazardous chemicals used at the CFFF are evaluated for their hazards and that this information, along with information about appropriate protective measures is transmitted to employees.
- An Energy Isolation and Lock Out Tag Out (LOTO) Program is implemented to protect employees and contractors from injuries that may result from the unexpected startup of equipment or the release of stored energy.
- Procedures also exist to provide information and guidance on selection of Chemical Personal Protection Equipment (PPE) to minimize the potential for chemical exposure injuries and illness.
- In areas where chemicals are stored, handled, or used, emergency eyewash and safety shower stations are installed to provide clean water to wash

chemicals from the face, skin, and eyes of individuals who are exposed to these injurious materials.

### 7.1.2 Program Practices

7.1.2.1 The CFFF Chemical Safety Program is designed to assure that processes and operations comply with applicable federal and state regulations pertaining to chemical safety.

7.1.2.2 The Chemical Safety Program is implemented to assure that hazards associated with the risk posed by chemicals used at the CFFF are evaluated, and that appropriate measures are taken to assure operations are performed in a safe manner.

7.1.2.3 Appropriate facilities, equipment, and procedures for the safe storage and handling of hazardous chemicals are maintained at the CFFF. Face velocity requirements for enclosures whose primary control function relates to chemical fumes, mists, and dusts follow industry recommendations per the American Conference of Governmental Industrial Hygienists (ACGIH) ventilation manual.

7.1.2.4 Employees using hazardous chemicals are specifically trained in procedures for safe handling and disposal of them.

7.1.2.5 The Chemical Safety Program includes evaluations of:

(a) Potential physical, chemical, and/or fire hazards;

(b) Development and implementation of safety programs and procedures designed to minimize accidents and injuries to employees;

(c) Purchase and maintenance of protection and monitoring equipment; and,

(d) Maintenance of appropriate records and reports.

7.1.2.6 The Site Emergency Plan and Implementing Procedures, described in Chapter 9.0 of this License Application, detail the manner in which the CFFF responds to any accidental release of hazardous chemicals.

### 7.1.3 Performance and Documentation of Analyses

7.1.3.1 Hazard and Operability (HAZOP) Analysis, What-If/Checklist, and/or other recognized methods are used to systematically evaluate the safety of chemical operations at the CFFF. The hazard evaluation method selected is based on the complexity of the process being analyzed.

7.1.3.2 Hazards to be evaluated are based on the nature of the chemicals involved, the process conditions (flow, temperature, pressure, concentration, etc.), personnel experience, and information about previous incidents in the facility. The evaluation is used to assure that adequate safety margin is present in each chemical process. For areas where additional safety controls might be required, action items are recommended for increasing the safety margin of the process, in accordance with CFFF priorities and resources.

7.1.3.3 The physical design and implementation of chemical operations at the CFFF is evaluated to identify deviations from the intended operation, which could result in potential hazards or operational concerns. These hazards include the following, when applicable:

(a) Potential for criticality safety incidents;
(b) Potential to violate a License commitment;
(c) Potential for personnel exposure or injury; and/or,
(d) Potential for radioactive contamination, release of chemicals to the atmosphere, fire or explosion.

7.1.3.4 Chemical Safety Analysis

(a) Analysis Performance

(1) The Chemical Safety Analysis is a comprehensive assessment of each component within a defined system. The analysis identifies controls required to maintain a sufficient margin of safety.

(2) Chemical accident sequences are analyzed using the accident flow diagram format. In this format, the analyst traces each sequence through the diagram (starting with the initiating event) to arrive at a consequence of interest. Each identified pathway defines an initiating event and protective measure failures that collectively represent an accident sequence.

(3) All relevant chemical hazard exposure pathways are included in the Chemical Safety Analysis.

(b) Analysis Documentation

(1) The Chemical Safety Analysis is one of the ISA safety analyses described in Chapter 4.0 of this License Application. The level of detail for a particular analysis is based on the complexity of the initial system, and subsequent proposed changes to the system. Thus, the scope and content of a Chemical Safety Analysis are customized to reflect the particular characteristics and needs of the system being analyzed.

(2) Chemical Safety Analyses are maintained current through implementation of the Configuration Management program described in Sections 3.1 and 4.1 of this License Application. Subsequent changes that might affect the Baseline ISA are reviewed by the Chemical Safety Function. If Chemical Safety Analysis is required for a proposed change, it is performed to current standards.

### 7.1.4 Audits

Audits are conducted to compare established chemical safety standards to CFFF performance. These audits are performed in accordance with the requirements in Section 3.6 of this License Application.

- The Chemical Safety Program is audited on a triennial frequency.
- The CFFF ISA is audited on a five year frequency.
- Results of the audit are documented, and findings are put into the CAP and maintained for NRC Staff review and inspection.

# CHAPTER 8.0

# FIRE SAFETY PROGRAM

## 8.1 FIRE SAFETY PROGRAM STRUCTURE

The CFFF maintains a robust Fire Safety Program for protection of the site. A primary purpose of this Fire Safety Program is to minimize the occurrence and consequence of fires in and about the facility. Fire protection is achieved by combinations of fire protection measures and systems. Such measures and systems are designed and maintained in accordance with industry standards and prudent industry practices. The standards and practices most often consulted are those of the National Fire Protection Association (NFPA).

### 8.1.1 Basic Fire Protection

8.1.1.1 Fire Safety Program management organization, authorities, and responsibilities conform to the structure presented in Chapter 2.0 of this License Application. The Authority Having Jurisdiction (AHJ) at the CFFF for fire safety program implementation is held by the Fire Safety Function unless mandated by local regulation, where the specifically required AHJ is utilized (e.g., Richland County Fire Marshall).

The AHJ is responsible for resolving conflicts to NFPA code commitments by evaluating whether the provisions of the NFPA code commitments are being met and, if not being met, approving alternate methods that demonstrate equivalency to the specific NFPA code commitment found to be in conflict. If an NFPA code commitment cannot be met and an alternate method that provides an equivalent level of safety cannot be identified, a formal request to approve that exemption (deviation) from the NFPA code commitment shall be submitted to the NRC for review and approval prior to its implementation. AHJ-approved equivalency justifications are retained for NRC review and inspection.

8.1.1.2 The CFFF is designed to provide protection against fires and explosions that could affect the safety of licensed materials and thus present an increased radiological risk.

8.1.1.3 Fire alarm pull stations are strategically located throughout the facility. Areas with potential fire hazards are equipped with appropriate fire detection and/or suppression systems. Criticality concerns/controls restrict the use of water for fire suppression in identified plant areas.

8.1.1.4 The Security Function is responsible for announcing alarms and alerting personnel to fire incidents through use of the facility public address system. Following announcement of an alarm, instructions are provided to personnel with any necessary protective actions to be taken.

8.1.1.5 An approved cutting and welding procedure, a welder training program, and hot work permits are provided to control torch use activities.

8.1.1.6 Flammable liquids are retained in containers and/or cabinets designed for such purpose, and additional precautions are taken as specified by the Fire Safety Function. Non-routine use of flammable materials is controlled by the same precautions used for routine use of such materials.

8.1.1.7 Periodic emergency drills are conducted as part of the Emergency Management Program described in Chapter 9.0 of this License Application. An emergency exercise, that includes facility evacuation, is conducted on an annual basis. At times prescribed by the Fire Safety Function, a fire scenario is included as part of such an exercise/or drill.

8.1.1.8 Review and control of modifications to the facility or processes to minimize fire hazards are implemented as described in Section 3.1 of this License Application.

8.1.1.9 A fire protection preventive maintenance program is in place, and relevant documentation is maintained for the maintenance activities, as described in Section 3.2 of this License Application. Inspection, testing, and maintenance of fire protection equipment is covered by this program.

8.1.1.10 The results of the CFFF fire hazard analysis are incorporated into the ISA.

8.1.1.11 Basic fire protection training is covered in new-hire and contractor orientation programs as described in Section 3.4 of this License Application. An Emergency Response team is given extensive additional training.

8.1.1.12 Approved procedures, as described in Section 3.4 of this License Application, define reporting guidelines and investigation requirements for fire incidents.

8.1.1.13 Approved procedures also prescribe the housekeeping practices for the facility. Good housekeeping techniques are practiced at the facility as an integral part of the Human Performance culture described in Section 3.5 of this License Application.

8.1.1.14 A formal system is provided to enable reporting of fire incidents to First Level Management for action, as described in Section 3.7 of this License Application.

8.1.1.15 Fire Safety Program records are maintained, as described in Section 3.9 of this License Application.

Details of these and other Fire Safety Program elements are presented in the balance of this Section.

### 8.1.2 Building Construction

The construction standards for the CFFF manufacturing areas are those which prevailed at the time the areas were originally constructed. The building structural members were built using non-combustible, or limited combustible materials. Whenever the building structure is expanded, or otherwise modified, current NFPA code requirements are addressed.

These areas conform to the following, as specified by the Fire Safety Function:

(a) location and manning requirements;
(b) fire barrier ratings;
(c) fire detection requirements;
(d) sprinkler, or other fire suppression method, specifications;
(e) container and containment specifications;
(f) wiring grades;
(g) combustible material inventory controls; and/or,
(h) housekeeping practices.

8.1.2.1 To minimize exposure to fire risk, the facility employs guidance from applicable NFPA standards.

8.1.2.2 To enable rapid personnel egress from buildings in the event of a fire, the facility employs guidance from the NFPA 101 standard.

8.1.2.3 Electrical installations and wiring also conform to applicable industry standards, e.g., NFPA 70.

8.1.2.4 Lightning protection of steel buildings is maintained by use of grounding straps, and equipment specified by the Fire Safety Function is also grounded.

### 8.1.3 Ventilation Systems

8.1.3.1 Facility heating and ventilation systems are designed for fire protection.

8.1.3.2 Space heating furnaces are built to industry and NFPA 70 standards.

8.1.3.3 Fire barrier penetrations employ fire dampers designed to specifications.

8.1.3.4 Automatic closing is required for fire doors and dampers.

8.1.3.5 Underwriters Laboratories (UL) listed final HEPA filters are used.

### 8.1.4 Process Fire Safety

8.1.4.1 Principal chemicals used at the facility are evaluated for their fire hazards, and their control is specified by the Fire Safety Function. In particular, the following chemicals are so controlled:

(a) Ammonium hydroxide;
(b) Hydrogen;
(c) Nitric acid;
(d) Sulfuric acid;
(e) Natural gas; and
(f) Fuel oil - diesel.

Uses of such chemicals conform to the following items as specified by the Fire Safety Function:

- hazard recognition by handlers;
- training in safe handling and spill prevention techniques;
- storage;
- containment;
- maintenance;
- leak testing; and/or,
- safety shut-off valve verifications.

8.1.4.2 Processes involving use of flammable gases are not introduced to the facility until they are evaluated, and their controls have been specified by the Fire Safety Function. In particular, the following controls are applied to flammable gas processes:

(a) Construction, installation, operation and maintenance of bulk gas storage, loading and dispensing systems are in accordance with prudent industry practice, e.g., NFPA 55;

(b) Combustible gas analysis is performed prior to hot (open flame) work, as specified on work permits;

(c) Sintering furnaces are provided with flame curtains designed to continually burn off excess hydrogen gas upon release of furnace atmosphere. Process interlocks are employed to assure proper operation of the flame curtains; and,

(d) Sintering furnaces have been upgraded to meet the NFPA 86 standards in effect at the time of the upgrade.

8.1.4.3 Processes involving use of flammable and combustible liquids are not introduced to the facility until they are evaluated, and their controls have been specified by

the Fire Safety Function. In particular, the following controls are applied to flammable and combustible liquid processes:

(a) Flammable and combustible liquid storage systems are designed and maintained as specified by the Fire Safety Function;

(b) Construction, installation, operation and maintenance of bulk liquid storage, loading and dispensing systems are in accordance with prudent industry practice, e.g., NFPA 30;

(c) Above ground storage tanks are provided with emergency relief vents in accordance with industry standards;

(d) Supports for aboveground storage tanks are protected from potential exposure to fires; and,

(e) Indoor storage of flammable and combustible liquids is evaluated, and appropriate fire extinguishers are kept immediately available.

8.1.4.4 The fire hazard in handling of uranium oxides has been evaluated. Non-combustible materials are specified for powder handling systems where the potential for spontaneous exothermic reaction needs to be considered. Where high density polypropylene containers are used for storage and transport of active uranium oxides, operators are trained to recognize hazardous powder characteristics and are instructed on how to monitor for exothermic reactions in such containers.

8.1.4.5 Machining operations on combustible metals at the facility are evaluated for their fire hazards, and appropriate controls are specified by the Fire Safety Function. In particular, the following operations involving potential for zirconium metal fines are controlled by approved procedures:

(a) Fuel rod repair stations;
(b) Final fuel assembly loaders;
(c) Laser welders;
(d) Zirconium grid strap production areas;
(e) Mechanical development laboratories; and,
(f) Tool rooms.

Such areas conform to containment, ventilation, filtration and/or fire extinguisher requirements, as specified by the Fire Safety Function.

8.1.4.6 The Facility Incinerator

The facility incinerator is isolated from the rest of the facility by a rated fire barrier. Incinerator exhaust is passed through a water media for cooling and dust separation. The

exhaust is then routed through a filtration and sampling system prior to release to the environment.

8.1.4.7 Boilers and boiler-furnaces are evaluated, and their controls are specified by the Fire Safety Function. In particular, the following controls have been applied:

(a) Boilers are contained in non-fire-rated boiler houses that are physically separated from manufacturing buildings;

(b) Fuel storage tanks are separated from boiler houses; and, fuel lines are marked for identification and are located to minimize damage potential; and,

(c) Construction and operation of boiler-furnaces is in accordance with industry standards.

8.1.4.8 Stationary combustion engines are evaluated, and their controls are specified by the Fire Safety Function. In particular, the following controls have been applied:

(a) Stationary combustion engines are located in rooms constructed of non-combustible materials;

(b) Engine exhaust systems are designed to prevent ignition of combustible material by contact with hot metal surfaces, or by leaking exhaust gases or sparks;

(c) Engine rooms are configured such that process-generated dusts and flammable vapors cannot enter;

(d) Engine rooms are ventilated to minimize accumulation of combustible vapors. The ventilation systems are automatically activated when engines are started;

(e) Back-up generator areas located inside the main building are protected by a sprinkler fire suppression system; and,

(f) Fire pump storage tanks are constructed in accordance with industry standards.

8.1.4.9 Hoods and gloveboxes have been evaluated for fire hazards, and their controls are specified by the Fire Safety Function. In particular, the following controls have been applied:

(a) Hoods and gloveboxes are constructed primarily of metal, using glass and/or fire resistant plastic for viewing areas. The plastic conforms to a Class-I fire rating; and,

(b) Explosive mixtures in gloveboxes are prevented, using inert gas or dry air atmospheres when required.

8.1.4.10 Fire protection methods for laboratories handling radioactive materials are in accordance with industry standards.

### 8.1.5 Fire Detection and Alarm Systems

8.1.5.1 Automatic fire detectors are installed in areas with a substantial combustible loading and/or in areas with infrequent occupancy, as specified by the Fire Safety Function, unless such areas are covered by automatic fire suppression systems.

8.1.5.2 Plant hydrogen systems have been evaluated as documented in the ISA and it has been determined by the Fire Safety Function that the potential for leakage is minimal and/or sufficient dilution air is present to prevent formation of explosive mixtures. Therefore, no automatic flammable vapor/gas detectors are installed.

8.1.5.3 Audible fire alarms are installed in locations throughout the facility, and supplementary visual alarms are installed in high noise areas, as specified by the Fire Safety Function. These alarms are supervised by a continuously manned, central control station that monitors the fire detection system and zone status.

8.1.5.4 Manual fire alarm actuators (pull-boxes) are installed in specified locations throughout the facility, as specified by the Fire Safety Function.

### 8.1.6 Fire Suppression Equipment and Services

8.1.6.1 Fire Suppression Equipment

(a) Selection of equipment for suppression of fire takes into account the severity of the hazard, the type of activity to be performed, the potential consequences of a fire, and the potential consequences of use of the suppression equipment (*e.g.*, risk of an accidental criticality, or substantial electrical hazard).

(b) Multiple 6-inch fire hydrants, with 2.5-inch hose connectors, are installed at strategic locations about the facility site.

(c) Multiple 1.5-inch standpipes are strategically located throughout the facility. Standpipe and hose systems are selected and designed in accordance with industry standards. Standpipe and hose systems have readily accessible hose outlet locations.

(d) Automatic sprinkler systems are selected and designed in accordance with industry standards. Automatic sprinkler systems are specifically

excluded from areas where moderation control is specified by the NCS Function as a principle controlled parameter, and/or in areas with a high concentration of energized electrical equipment.

(e) Portable fire extinguishers, with sufficient capacity and the proper type of suppression agent, are available and maintained throughout the facility. Portable fire extinguishers are selected and deployed in accordance with industry standards, e.g., NFPA 10.

8.1.6.2 Fire Suppression Services

(a) Water supply for fire protection systems is assured. The 10-inch water main that supplies process and drinking water to the site also supplies two water tanks. A single tank contains the necessary volume of water to supply the most demanding suppression and hose stream requirements as prescribed in NFPA 801 and NFPA 13. The tanks are equipped with automatic fill capability to maintain water level.

(b) Fire pump installations are designed to deliver water to hydrants, standpipes, and sprinkler systems.

(c) Back-up power for fire pumps is provided. Diesel pumps are test-started on a weekly frequency, and two sets of batteries are provided for back-up starting. Emergency response personnel are trained to start the pumps manually.

(d) The water distribution system is designed such that failure of a single component does not disable the supply of fire suppression water to the facility.

(e) The fire pumps, pre-action sprinklers, deluge systems, and hydrants are operationally tested in accordance with testing frequencies specified by NFPA 25.

### 8.1.7 Emergency Response Team

8.1.7.1 The Emergency Response Team is established, and firefighting equipment is maintained, as part of the Emergency Management Program described in the Site Emergency Plan and Procedures, as presented in Chapter 9.0 of this License Application.

8.1.7.2 Training to enable performance of duties in response to facility fires is provided to the Team as part of the Emergency Management Program described in the Site Emergency Plan and Procedures, as presented in Chapter 9.0 of this License Application.

### 8.1.8 Pre-Fire Plans

8.1.8.1 The CFFF maintains ready for use, and for inspection by Regulatory Agencies, comprehensive Pre-Fire Plans that provide the strategic and tactical information needed by fire-fighting personnel when responding to an emergency.

8.1.8.2 Pre-Fire Plans include the following information:

(a) Division of the facility into logical planning areas.
(b) Site sketches that identify:
- Locations of areas;
- Response Team assembly points;
- Assembly point coverage areas; and,
- Locations of fire hydrants.

(c) Assignment of basic Response Team responsibilities, and Team checklists.
(d) Listings of fire detection and protection devices.
(e) Details of:
- Area description;
- Expected occupancy;
- Potential locations for trapped occupants;
- Potential disabled personnel that might require emergency assistance;
- Information about area utilities;
- Construction information;
- Schedule for Plan updates;
- Basic information on hazardous materials in the area;
- Fire-fighting strategy considerations; and
- Supplementary information (e.g. water drainage and smoke ventilation) specified by the Fire Safety Function.

8.1.8.3 Pre-Fire Plans (and revisions to the Plans) are prepared and maintained by the Fire Safety Function. Copies of the Plans are made available for use by the off-site fire department most likely to respond to a call for assistance.

### 8.1.9 Fire Safety Analysis

8.1.9.1 Performance and Documentation of Analysis

(a) Analysis Performance

(1) The Fire Safety Analysis is a comprehensive assessment of each component within a defined system. The analysis identifies controls required to maintain a sufficient margin of safety.

(2) Fire accident sequences are analyzed using the accident flow diagram format. In this format, the analyst traces each sequence through the diagram (starting with the initiating event) to arrive at a consequence of interest. Each identified pathway defines an initiating event and protective measure failures that collectively represent an accident sequence.

(b) Analysis Documentation

(1) The Fire Safety Analysis is one of the ISA safety analyses described in Chapter 4.0 of this License Application. The level of detail for a particular analysis is based on the complexity of the initial system, and subsequent proposed changes to the system. Thus, the scope and content of a Fire Safety Analysis are customized to reflect the particular characteristics and needs of the system being analyzed.

(2) Fire Safety Analyses are maintained current through implementation of the Configuration Management program described in Sections 3.1 and 4.1 of this License Application. Subsequent changes that might affect the Baseline ISA are reviewed by the Fire Safety Function. If Fire Safety Analysis is required for a proposed change, it is performed to current standards.

### 8.1.10 Audits

Audits are conducted to compare established fire safety standards to CFFF performance. These audits are performed in accordance with the requirements in Section 3.6 of this License Application.

- The complete Fire Safety Program is audited on a triennial frequency.
- The CFFF ISA is audited on a five year frequency.
- Results of the audits are documented, and findings are put into the CAP and maintained for NRC Staff review and inspection.

# CHAPTER 9.0

# EMERGENCY MANAGEMENT PROGRAM

The CFFF maintains a comprehensive Emergency Management Program with facilities, equipment and processes for protecting workers, the public and the environment. This program assures control of licensed material, capability to evacuate personnel, and availability of emergency measures and facilities. The program is documented in an approved Site Emergency Plan and Procedures. This program assures compliance with the requirements of ANSI/ANS-8.23(1997) for nuclear criticality accident emergency planning and response. At a minimum, the Plan and Procedures are reviewed annually to assure that the overall emergency preparedness program is being properly maintained.

## 9.1 EMERGENCY MANAGEMENT PROGRAM STRUCTURE

### 9.1.1 Site Emergency Plan

CFFF emergency preparedness practices are described in the latest revision of the Site Emergency Plan, submitted to NRC Staff, approved in accordance with applicable regulations, and maintained as prescribed by regulatory requirements. The Plan addresses the following emergency preparedness criteria:

(a) Facility Description;
(b) Engineered Safeguards for Abnormal Operations;
(c) Types of Accidents and Classifications;
(d) Response Management System;
(e) Mitigation of Consequences and Assessment of Releases;
(f) Emergency Response Facilities and Equipment;
(g) Maintaining Emergency Preparedness Capability;
(h) Records and Reports;
(i) Safe Shutdown, Recovery, and Plant Restoration; and,
(j) Hazardous Chemicals.

### 9.1.2 Emergency Procedures

Implementing procedures, approved in accordance with CFFF policy, contain detailed instructions on emergency response and emergency personnel activities based on practices required by the Site Emergency Plan. These procedures clearly define duties, responsibilities, action levels, and actions to be taken by each functional individual or group in response to emergency situations. Copies of Emergency Procedures, and subsequent changes to them, are issued to personnel responsible for emergency response activities. The procedures address the following emergency preparedness criteria:

(a) Emergency Response Organization;
(b) Emergency Response Team;
(c) Equipment and Supplies;
(d) Evacuation, Accountability, and General Response;
(e) Classification;
(f) Communication;
(g) Notification;
(h) Biological Threat;
(i) Bomb Threat (Package or Object);
(j) Bomb Threat (Telephone or Correspondence);
(k) Civil Disturbance;
(l) Criticality;
(m) Explosion;
(n) Fire;
(o) Hazardous Material Release;
(p) Hazardous Weather;
(q) Loss of Utilities;
(r) Oil Spill;
(s) Radioactive Powder or Liquid Release;
(t) Transportation Accident; and,
(u) $UF_6$ Release.
(v) Local Law Enforcement Agency Incident Response Plan; and,
(w) Notification Guidelines for NRC and Other Agencies.

# CHAPTER 10.0

# ENVIRONMENTAL PROTECTION

## 10.1 ENVIRONMENTAL PROTECTION PROGRAM STRUCTURE

The CFFF maintains an Environmental Protection Program for the site. A primary purpose of the Environmental Protection Program is to prevent inadvertent releases to the environment and to assure that exposure of the public and the environment to hazardous materials used in facility operations are kept well below permissible limits.

The CFFF prepared an Environmental Evaluation Report, dated March 1975, that was subsequently updated in revisions dated April 1983, April 1990, December 2004, December 2014, March 2018 and March 2019. The March 2019 revision consolidates and supersedes the information from the December 2014 and March 2018 reports. Also, an extensive update of much of the information in the March 1975 report was documented in the ISA and ISA Summary titled "*CFFF Site and Structures*."

### 10.1.1 Gaseous Effluent Control

For operations with the potential to exhaust radioactive materials to unrestricted areas, representative stack sampling is performed to determine the adequacy of air effluent controls. Such sampling is performed during production operations involving licensed materials and the results are used to demonstrate compliance with applicable regulatory limits. Sampling and monitoring methods and frequencies (i.e., continuous sampling, periodic sampling or periodic administrative reviews for release points where material has little potential to be released) are determined in accordance with regulatory guidance.

ALARA goals and investigation limits are established based on guidance provided in Reg. Guide 8.37, Revision 0 (July 1993). If the investigation level is exceeded, corrective actions are taken to reduce emissions, as appropriate. If radioactivity in gaseous effluents results in a TEDE in excess of 10 mrem/yr to a member of the public in an unrestricted area, a report is submitted to NRC Staff within 30-days upon discovery. This report is prepared in accordance with 10CFR20.2203(b) and is submitted to NRC Headquarters with a copy to NRC Region II.

If measurement results indicate the TEDE (due to liquid and gaseous effluents) to any member of the public in a calendar year could exceed a limit of 100 millirem, immediate steps are taken to reduce emissions to levels that will bring the TEDE back below the limit.

### 10.1.2 Liquid Effluent Control

Liquid waste treatment facilities, with sufficient capacity and capability to enable retention, treatment, sampling, analysis, and discharge of liquid wastes in accordance with applicable regulations, are provided and maintained in proper operating condition.

Control of radioactivity in the process liquid waste stream is achieved by operation of two treatment systems in series:

(a) A continuous in-line gamma spectroscopy monitor and quarantine tank filtration system within the chemical controlled area of the main Plant building; and,

(b) A Wastewater Treatment Facility (for removing uranium to ALARA levels) that is external to the building.

The first system is installed following quarantine tanks, diversion tanks, and filtration operations. This system assures that the process liquid waste stream, being transferred from the internal chemical controlled area to the external treatment area, meets the discharge limit in approved operating procedures. This limit is nominally less than 24 parts per million uranium. When the liquid has successfully passed the scan for discharge from the first system, it is transferred from the in-plant final pump-out tank to the second system for further uranium removal.

The second system assures that uranium in the discharge is removed to a nominal limit of less than 0.2 parts per million uranium.

Goals and investigation limits are established based on guidance provided in Reg. Guide 8.37, Revision 0, to assure that liquid effluents are ALARA. If the investigation level is exceeded, corrective actions are taken to reduce radioactive effluent, as appropriate. If measurement results indicate the TEDE (due to liquid and gaseous effluents) to any member of the public in a calendar year could exceed a limit of 100 mrem, immediate steps are taken to reduce radioactive effluent to levels that will bring the TEDE back below the limit.

Miscellaneous liquid wastes are filtered and sampled on a batch basis to assure uranium is effectively removed to levels that will enable conformance to ALARA goals.

Quiescent settling in the North, South, East, and West Lagoons further reduce uranium levels in liquid wastes prior to final discharge to the Congaree River. A continuous, proportional sample of the liquid effluent discharged to Congaree River is collected. A monthly composite of this sample is analyzed for isotopic uranium and Tc-99 content.

If the CFFF's National Pollutant Discharge Elimination System (NPDES) Permit is renewed, revised or revoked, NRC Headquarters and Region II Staff are promptly notified. The CFFF will also notify NRC within 30 days of any NPDES Notice of Violation.

### 10.1.3 Solid Waste Disposal

Solid waste disposal preparation facilities, with sufficient capacity and capability to enable processing, packaging, and transfer of solid wastes to licensed treatment or disposal sites,

in accordance with applicable regulations, are provided and maintained in proper operating condition.

### 10.1.4 Environmental Sampling and Monitoring

The CFFF environmental sampling and monitoring program includes the sampling criteria presented in Table 10.1. Samples are either analyzed by the site's Chemical Laboratory or are sent off-site to a certified laboratory. Sampling methods are in accordance with approved Environmental Protection Agency (EPA)/Department of Energy (DOE) methods.

Action levels for sample results are established by approved procedures. (Note: For wells found not to contain water at the time of sampling, an evaluation is performed by the Environmental Protection Function to determine if alternate well data can be used to represent the dry well; or, if a new well must be installed.) Table 10.2 presents the well monitoring network, and typical program analytical sensitivities are presented in Table 10.3. Locations of air, vegetation and soil monitoring stations are presented in Figure 10.1. Figure 10.2 presents the locations of surface water monitoring stations, and the locations of monitoring wells are presented in Figure 10.3.

Surface water sampling locations:

- Entrance – Sample obtained from entrance side of flood gate valve that controls flow from Mill Creek Swamp into Upper Sunset Lake. GPS Coordinates: N-33˚52'59.72 W-80˚55'56.32
- Exit – Sample obtained from exit side of flood gate valve that controls flow from Sunset Lake Swamp into the canal. GPS Coordinates: N-33˚52'16.94 W-80˚55'28.52
- Pond (Gator) – Sample obtained from surface of pond. GPS Coordinates: N-33˚52'47.54 W-80˚55'17.46
- Spillway – Sample obtained from between Lower Sunset Lake and Sunset Lake Swamp. GPS Coordinates: N-33˚52'34.72 W-80˚55'14.58
- Causeway – Sample obtained from concrete flume connecting Upper and Lower Sunset Lakes. GPS Coordinates: N-33˚52'43.55 W-80˚55'24.
- Roadway – Sample is obtained from Plant side of roadway, where Control Valve A/B stream and Control Valve D/E stream connect. This is before the stream flows into Control Valve C. GPS Coordinates: N-33˚52'52.88 W-80˚55'20.68

A fish sample is taken annually from the Congaree River. Sediment samples are taken annually from the Gator Pond and Sunset Lake as well as near the Congaree River diffuser discharge point.

River water samples are taken at the following locations:

- Blossom Street Bridge;
- 500 yards above the discharge;
- 500 yards below the discharge; and

- Mill Creek.

These sampling criteria, sensitivities, and/or locations can be changed without prior NRC Staff approval provided:

(a) A documented evaluation by the Environmental Protection Function demonstrates that the changes do not decrease the overall effectiveness of the environmental sampling and monitoring program; and,

(b) The changes are submitted to NRC Staff as part of the subsequent updates of this License Application to enable opportunity to inspect the evaluation.

### 10.1.5 Conceptual Site Model

Environmental monitoring data is input into a Conceptual Site Model (CSM) on a periodic frequency. The CSM provides an understanding of how a contaminant release may be observed and measured currently in the site environment, and identifies the fate and transport of the contaminant in the future. The model incorporates what is known about the site's hydrogeology, existing and past site activities that may have resulted in contaminant releases to the environment, the locations of those releases, the contaminants of concern, their fate and transport within the environment, and the receptors of those contaminants.

Based upon current and historical operations, the facility has established defined Operable Units (OUs). The characteristics of each OU, combined with the CSM, inform the sampling and monitoring program.

Issues identified through the environmental sampling and monitoring programs are entered into the CAP described in Section 3.8 of this License Application. Assessment of the data follows the remediation process described in Section 11.1.1 of this License Application.

### 10.1.6 Periodic Reporting of Surveillance Data

Quantities of radioactive material in air and liquids released from the facility are reported to NRC Staff, in accordance with applicable regulatory guidance and regulations, on a semiannual basis.

Radiological monitoring data from Table 10.1 is summarized in the annual ALARA Report.

A copy of groundwater monitoring reports sent to South Carolina Department of Health and Environmental Control (SCDHEC) are provided to the NRC. In addition, updates to the Consent Agreement between Westinghouse and SCDHEC dated February 26, 2019 are provided to the NRC at least annually until closing of the agreement.

### 10.1.7 Off-Site Dose Control

10.1.7.1 Compliance with 10CFR20 (NRC) and 40CFR190 (EPA) requirements, for off-site dose to the maximally exposed member of the public, is assured by demonstrating that the annual dose equivalent does not exceed 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ. If any of these limits are exceeded, a report is submitted to NRC Staff within 30-days upon discovery. This report is prepared in accordance with 10CFR20.2203(b) and submitted to NRC Headquarters with a copy to NRC Region II. Dose calculation methodology includes models that have been evaluated and approved by the Environmental Protection Function and that have been recognized by the appropriate regulatory agencies.

10.1.7.2 If new surface water or well water sample analysis results exceed federal or state regulatory limits, a CAP shall be entered as described in Section 3.8 of this License Application to document the action(s) taken in response to the elevated analysis results.

## Table 10.1 Environmental Sampling Criteria

| TYPE OF SAMPLE | LOCATIONS | ANALYSES | MINIMUM SAMPLING FREQUENCY |
|---|---|---|---|
| Air Particulates | Four | Alpha | Continuous (Collection Weekly) |
| Surface Water | Six | Isotopic Uranium; Tc-99 | Quarterly |
| Well Water | Forty | Isotopic Uranium; Tc-99 | Semi-Annually |
| River Water | Four | Isotopic Uranium; Tc-99 | Quarterly |
| Sediment | Three | Isotopic Uranium; Tc-99 | Annually |
| Soil | Five | Isotopic Uranium; Tc-99 | Annually |
| Vegetation | Four | Isotopic Uranium; Tc-99; Fluoride | Annually |
| Fish | One | Isotopic Uranium; Tc-99 | Annually |

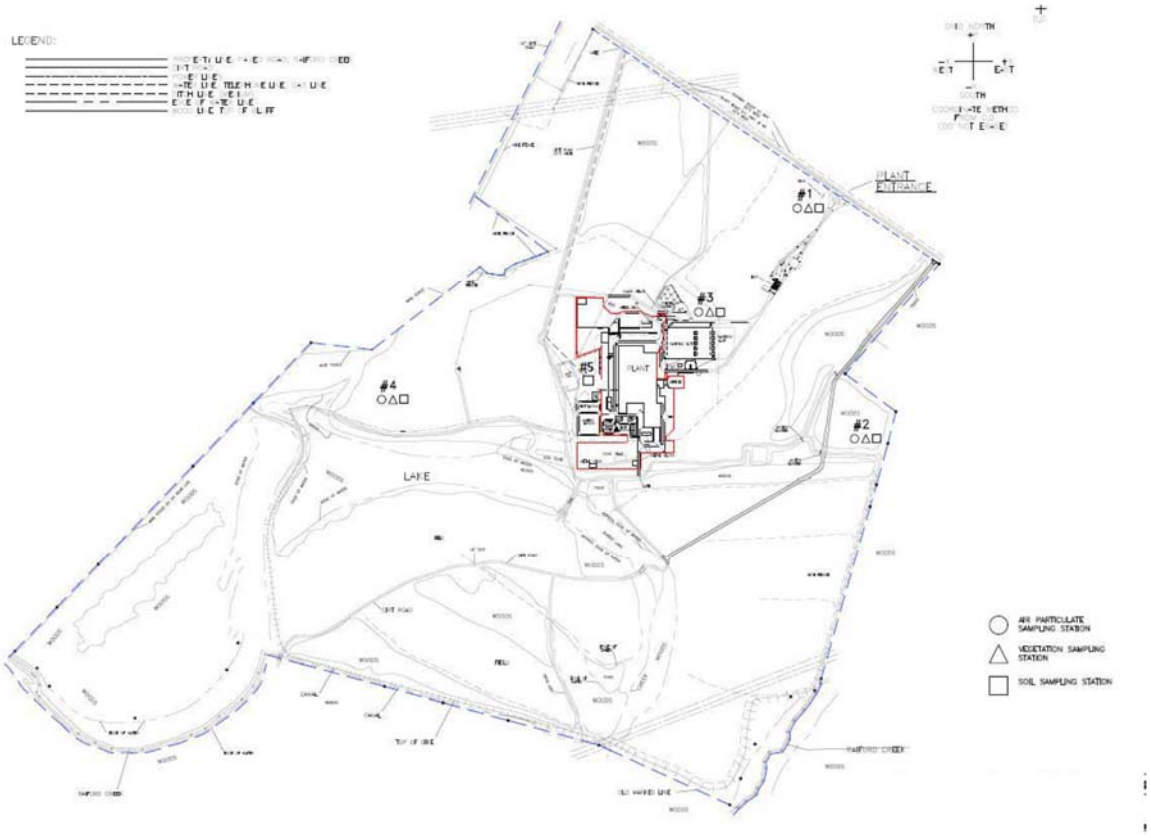
## Table 10.2 Well Monitoring Network

| Well Water Monitoring Network | | | | | | |
|---|---|---|---|---|---|---|
| **Well** | **Uranium** | **Tc-99** | | **Well** | **Uranium** | **Tc-99** |
| W-6 | X | X | | W-35 | X | X |
| W-7 | X | X | | W-36 | X | X |
| W-10 | X | X | | W-37 | X | X |
| W-11 | X | X | | W-38 | X | X |
| W-13 | X | X | | W-39 | X | X |
| W-14 | X | X | | W-3A | X | X |
| W-15 | X | X | | W-40 | X | X |
| W-16 | X | X | | W-41 | X | X |
| W-17 | X | X | | W-42 | X | X |
| W-18R | X | X | | W-43 | X | X |
| W-19B | X | X | | W-44 | X | X |
| W-20 | X | X | | W-45 | X | X |
| W-22 | X | X | | W-46 | X | X |
| W-23R | X | X | | W-47 | X | X |
| W-24 | X | X | | W-48 | X | X |
| W-26 | X | X | | W-49 | X | X |
| W-27 | X | X | | W-50 | X | X |
| W-28 | X | X | | WRW-2 | X | X |
| W-29 | X | X | | | | |
| W-30 | X | X | | | | |
| W-32 | X | X | | | | |
| W-33 | X | X | | | | |

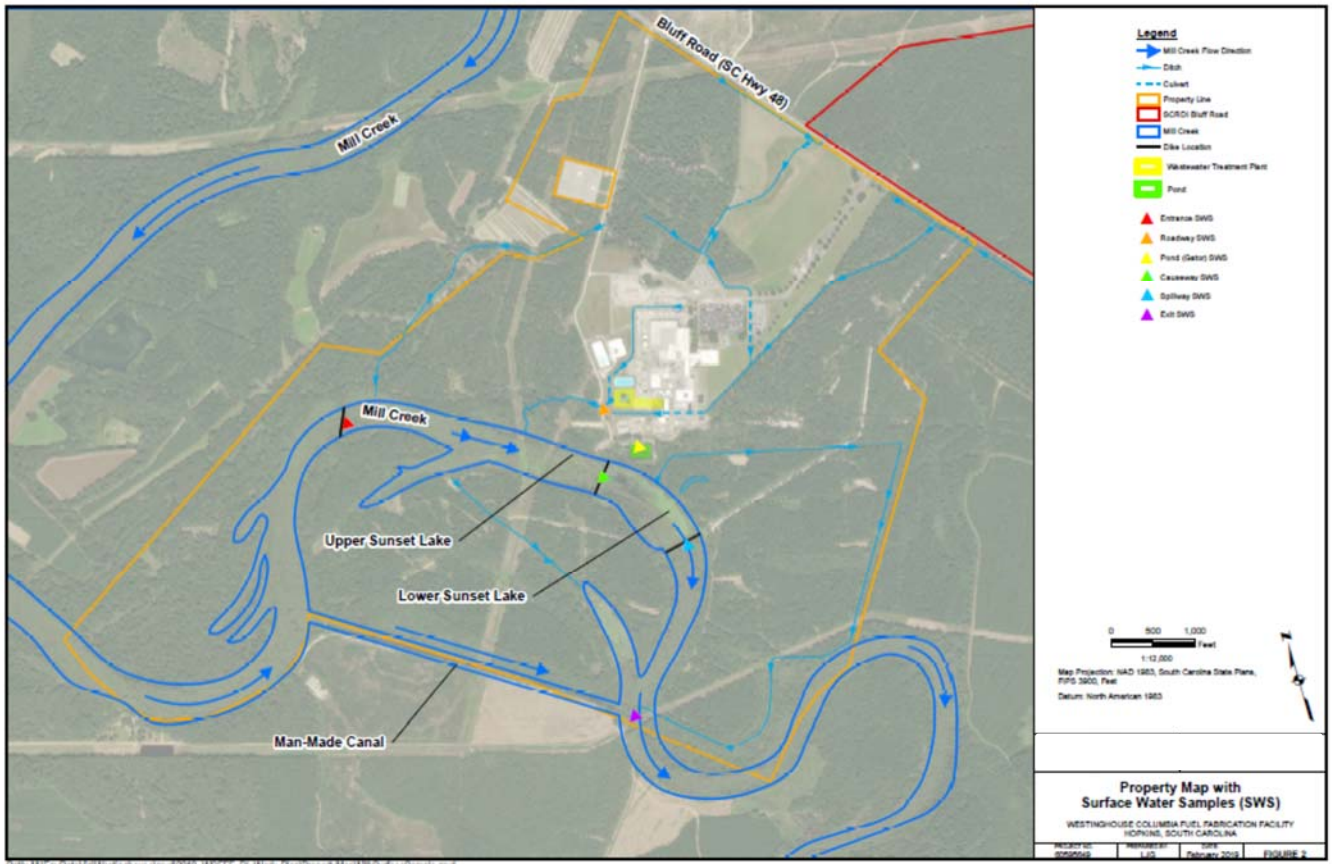
## Table 10.3 Typical Environmental Programs Radiological Analytical Sensitivities

| TYPE OF SAMPLE | ANALYSES[1] | TYPICAL SAMPLE QUANTITY | NOMINAL MINIMUM DETECTION LEVEL |
|---|---|---|---|
| Air Particulates | Alpha | 571 Cubic Meters | 6.0E-14 μCi/ml |
| Surface Water | Uranium | 1 Liter | 0.5 pCi/l |
| | Tc-99 | 1 Liter | 50 pCi/l |
| Well Water | Uranium | 1 Liter | 0.5 pCi/l |
| | Tc-99 | 1 Liter | 50 pCi/l |
| River Water | Uranium | 1 Liter | 0.5 pCi/g |
| | Tc-99 | 1 Liter | 50 pCi/l |
| Sediment | Uranium | 100 Grams | 0.5 pCi/g |
| | Tc-99 | 100 Grams | 50 pCi/g |
| Soil | Uranium | 100 Grams | 0.5 pCi/g |
| | Tc-99 | 100 Grams | 50 pCi/g |
| Vegetation | Fluoride | 100 Grams | Variable (based on dilution level) |
| | Uranium | 100 Grams | 0.5 pCi/g |
| | Tc-99 | 100 Grams | 50 pCi/g |
| Fish | Uranium | 1 Kilogram | 0.5 pCi/g |
| | Tc-99 | 100 Grams | 50 pCi/g |

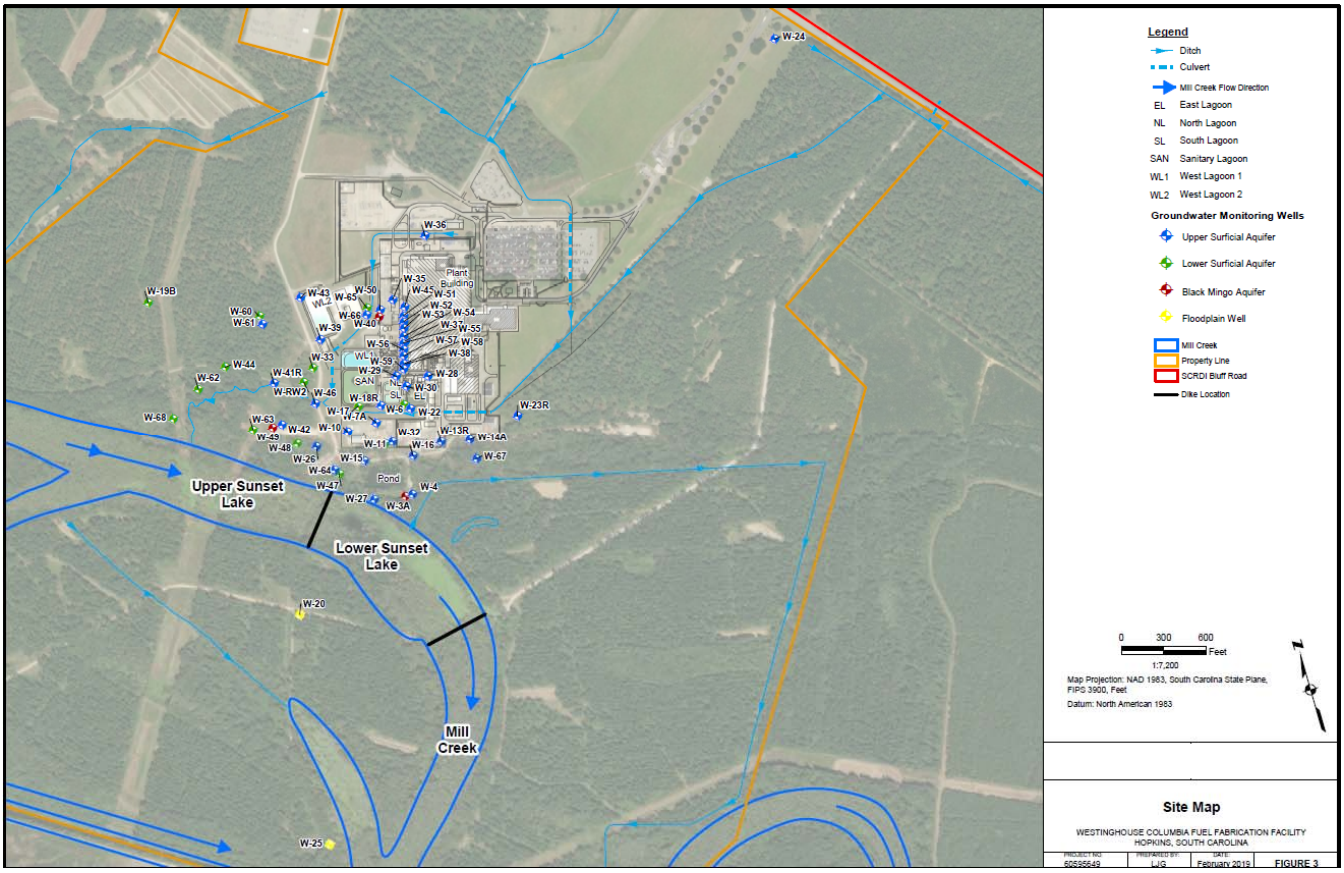
**Figure 10.1 Locations of Air, Vegetation and Soil Monitoring Stations**



## Figure 10.2 Locations of Surface Water Monitoring Stations



## Figure 10.3 Locations of Monitoring Wells



### 10.1.8 Performance and Documentation of Analyses

#### 10.1.8.1 Environmental Protection Analysis

Analysis Performance:

The Environmental Protection Analysis is a comprehensive assessment of each component within a defined system. The analysis identifies controls required to maintain a sufficient margin of safety.

Environmental accident sequences are analyzed using the accident flow diagram format. In this format, the analyst traces each sequence through the diagram (starting with the initiating event) to arrive at a consequence of interest. Each identified pathway defines an initiating event and protective measure failures that collectively represent an accident sequence.

Analysis Documentation:

The Environmental Protection Analysis is one of the ISA safety analyses described in Chapter 4.0 of this License Application. The level of detail for a particular analysis is based on the complexity of the initial system, and subsequent proposed changes to the system. Thus, the scope and content of an Environmental Protection Analysis are customized to reflect the particular characteristics and needs of the system being analyzed.

Environmental Protection Analyses are maintained current through implementation of the Configuration Management program described in Sections 3.1 and 4.1 of this License Application. Subsequent changes that might affect the Baseline ISA are reviewed by the Environmental Protection Function. If Environmental Protection Analysis is required for a proposed change, it is performed to current standards.

### 10.1.9 Audits

10.1.9.1 Audits are conducted to compare established environmental protection standards to CFFF performance. These audits are performed in accordance with the requirements in Section 3.6 of this License Application.

- The Environmental Protection Program is audited on a triennial frequency.
- The CFFF ISA is audited on a five year frequency.
- Results of the audits are documented, and findings are put into CAP and maintained for NRC Staff review and inspection.

10.1.9.2 Audits of vendors used to analyze environmental samples are performed, as needed. Such audits are also performed if substantive program anomalies are

disclosed. The audits consider the need for “spike” and/or “replicate sample” submittals, as part of evaluation of a vendor’s capability and quality control effectiveness.

# CHAPTER 11.0

# DECOMMISSIONING PLANNING

## 11.1 DECOMMISSIONING PLANNING STRUCTURE

To assure adequate financial resources are available to decommission the CFFF at the end of its useful life, the CFFF adheres to the decommissioning funding regulations in 10CFR70.25.

### 11.1.1 Conceptual Decommissioning Plan

The CFFF implements contamination control (see Sections 5.2.29 through 5.2.32 of this License Application) and waste minimization methods (see Section 10.1 of this License Application) to minimize contamination and reduce exposures and effluents. Following a leak or spill, the CFFF implements a remediation process, utilizing best practices from the Nuclear Energy Institute, the Industry Groundwater Protection initiative (NEI 07-07, Revision 1), and NRC Reg. Guide 4.22, Revision 0, to prevent migration of licensed material off-site and/or to minimize decommissioning impacts.

The remediation process outlines the decision making to remediate the release or document the reasoning to delay remediation. To make an informed decision, the process requires updating the CSM, including the migration pathways and potentially affected receptors. The process also guides the evaluation, documentation, and recordkeeping of the decommissioning impacts resulting from any action taken.

In support of the *Cost Estimate to Terminate License SNM-1107*, Westinghouse maintains records of information important to decommissioning in accordance with 10CFR70.25(g).

The documents required by this Section of the License Application are maintained as records in accordance with Section 3.9 of this License Application.

### 11.1.2 Decommissioning Funding Plan

The decommissioning funding plan includes a cost estimate for decommissioning the CFFF at the end of its useful life and the financial assurance mechanism used to secure the funds associated with the decommissioning cost estimate.

(a) Decommissioning Cost Estimate

The decommissioning cost estimate is submitted to NRC Staff for review and approval in accordance with 10CFR70.25.

(b) Financial Assurance Mechanism

Westinghouse has established a financial assurance mechanism, covering the cost estimate for decommissioning. The financial assurance mechanism is submitted to NRC Staff for review and approval in accordance with 10CFR70.25.

# CHAPTER 12.0

# AUTHORIZATIONS AND EXEMPTIONS

## 12.1 AUTHORIZATIONS

### 12.1.1 Authorization to Make Changes to License Commitments

Westinghouse may make changes to the License Application without prior NRC approval provided the change meets the following provisions:

- The change does not decrease the effectiveness of the safety program commitments in the License Application;
- The change does not result in a departure from the safety program evaluation methods described in the License Application;
- The change satisfies the performance requirements of 10 CFR 70.61 (i.e., the change does not result in a degradation of safety);
- The change does not affect compliance with applicable regulatory requirements;
- The change does not affect Section 10.1.7.2; and
- The change does not conflict with an existing license condition.

Records of such changes shall be maintained, including justification and management approval.

Within 6 months after each change is made, the licensee shall submit the revisions to the License Application to the Director, NMSS, using an appropriate method listed in 10 CFR 70.5(a), with a copy to the appropriate NRC regional office.

### 12.1.2 Authorization for Leak-Testing Sealed Plutonium Sources

The following procedure shall be authorized for leak-testing sealed plutonium sources at the licensed activity:

- Each sealed plutonium source in use shall be leak-tested at least semi-annually. In absence of a certificate from the supplier indicating that such a test has been performed within six month prior to transfer to the licensed activity, the subject sealed plutonium source shall not be put into use until leak-tested.

- Sealed plutonium sources that are stored, and are not being used, shall be exempt from the leak-test requirement. Such stored sources shall be leak-tested prior to any use in, or transfer from, the licensed activity unless such a test has been performed within the six months preceding the date of use or transfer.

- The leak-test shall be capable of detecting the presence of 0.005-microcuries, or more, of alpha contamination on a smear-test sample. The smear-test sample shall be taken directly from the sealed source, or from appropriate accessible surfaces of the device in which the source is mounted or stored.

- Records of leak-test results shall be kept in units of microcuries, or other units directly convertible to microcuries by multiplication using a recognized constant; and, the records shall be maintained for review by the NRC Staff.

- If a leak-test reveals the presence of 0.005-microcuries limit, the licensed activity shall file a report with the NRC Staff Headquarters which describes the subject source, the leak-test results, the extent of any related contamination, the apparent cause of failure, and corrective actions taken. A copy of this report shall also be sent to the NRC Region II Staff.

### 12.1.3 Authorization for Possession at Reactor Sites

The licensed activity may possess unirradiated fuel assemblies, at nuclear reactor facilities anywhere within the United States, for the purpose of loading them into shipping packages, and delivery to an authorized carrier for transport in accordance with the regulations. Operations incident to such loading shall be subject to the control of a licensed activity representative, approved by the Manager of the Regulatory Component, who shall assure that the completed transport package complies with all requirements of the regulations.

For such operations, the licensed activity shall be exempted from conditions of 10CFR70.24 *Criticality Accident Requirements*, provided:

- As finished fuel assemblies are removed from their approval storage facilities, they shall be constrained in an arrangement that is no more reactive than that which they will assume in the shipping package.

- The total number of fuel assemblies in process at any one time shall not exceed the maximum authorized contents of the packaging being loaded.

- If two fuel assemblies are in movement at the same time, a 12-inch minimum edge-to-edge separation shall be maintained between them; and, only one fuel assembly at a time shall be loaded into the shipping package.

- Loaded packages shall be stored in the approved shipping array, pending delivery to a carrier.

- No more than the maximum number of packages authorized for a single shipment shall be loaded and possessed, in conduct of such operations by the licensed activity, at any one location.

### 12.1.4 Authorization for Transfers as Non-Regulated Material

Pursuant to 10CFR20.2002 *Method for Obtaining Approval of Proposed Disposal Procedures*, industrial waste treatment products from the licensed activity, such as calcium fluoride and other homogenous mixtures in which the mean concentration of uranium constituents does not exceed 30-picocuries per gram, may be released without continuing NRC licensing controls, to receivers for off-site calcium fluoride drying and briquette manufacturing, or for cement or brick manufacturing, or to disposition at a chemical disposal site or industrial landfill. Calcium fluoride so released to off-site manufacturers shall contain a minimum of 60-percent solids. Prudent efforts shall be made to reduce the radioactive contents of all such transferred materials to level as low as reasonably achievable.

A sampling plan shall be implemented to characterize the industrial products in accordance with NUREG/CR-2082; "*Monitoring For Compliance With Decommissioning Termination Survey Criteria*" as follows:

- The estimation of the population mean for uranium concentration shall be representative of the industrial products being transferred;

- The sample size used to calculate the mean uranium concentration value shall be determined such that the 95-percent confidence limit for the value is less than 25-percent of the value;

- The sampling plan is to provide a minimum confidence level of 95-percent that the true mean uranium concentration value, determined for the industrial to be transferred, is less than the maximum permissible limit of 30-picocuries per gram of dry material.

- Records pertaining to the release of such materials, including identities of receivers, shall be maintained for review by the NRC Staff.

### 12.1.5 Authorization to Release Contaminated Records

The licensed activity may abandon or dispose of small quantities of radioactive materials that are present as minor contamination on certain papers, notebooks, computer print-outs, films, and/or similar items retained for record purposes. No licensed controls shall be required for final disposition of such records, and they may randomly be mingled with, and/or disposed of as, other records, provided:

- Prior to transfer from Contamination Control Areas at the licensed facility, a documented survey instrument measurement shall conclude that the following limits are not exceeded: Average uranium-alpha contamination of 220-

disintegrations-per-minute per 100-square-centimeters; Maximum uranium-alpha contamination of 2200-disintegrations-per-minute per 100-square-centimeters. Average beta-gamma emitter contamination of 660-disintegrations-per-minute per 100-per-square-centimeters; Maximum beta-gamma emitter contamination of 6600-disintegrations-per-minute per 100-square-centimeters.

- Such records shall be kept in locations that are used primarily for record storage and/or disposal.

### 12.1.6 Authorization to Release for Unrestricted Use

Licensed activity material and equipment may be released from contamination areas on-site to clean areas on-site, or from on-site possession or use to unrestricted possession or use off-site provided such releases are subject to all applicable conditions of the NRC Staff's April 1993 document entitled: *Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material.*

### 12.1.7 Authorization to Use ICRP 68

DAC and ALI values based on the dose coefficients published in ICRP Publication No. 68 may be used in lieu of the DAC and ALI values in Appendix B of 10CFR 20 in accordance with internal procedures.

## 12.2 EXEMPTIONS

### 12.2.1 Exemption from Prior Commitments

Commitments made to NRC Staff prior to the approval date of this License Application shall be no longer binding upon Westinghouse, following approval of this License Application, unless re-imposed as License Conditions or as modifications to the License.

### 12.2.2 Exemption from Individual Container Posting

Notwithstanding the requirement of paragraph (a) of 10CFR20.1904, *Labeling Containers*, the licensed activity shall be exempted from the requirement that "each container of licensed material bears a durable clearly visible label" provided, in lieu thereof, a sign bearing the legend "EVERY CONTAINER OR VESSEL IN THIS AREA MAY CONTAIN RADIOACTIVE MATERIAL" is posted at each entrance to areas for buildings in which radioactive materials are used or stored, from areas in which such materials are not used or stored. Regarding storage of radioactive material outside the Fuel Manufacturing Building, the number of posted buildings and size of posted areas shall be minimized to the extent practicable, consistent with manufacturing and storage requirements.

### 12.2.3 Exemption from Criticality Monitoring System Requirements

Notwithstanding the requirement of 10CFR 70.24, the licensed activity shall be exempted from the "monitoring system" requirements in the areas, and under the conditions specified below:

Office and conference room areas, chemistry laboratories, metallurgical laboratories, development laboratories, health physics counting rooms, and machine shop – provided that:

- Each such area shall be remote from other operations with SNM.
- Each such area shall be administratively limited to 1000 grams of U-235; and, for chemistry laboratories, an additional 5 grams of U-233.

Low concentration storage areas in which containers have uranium in quantities representing no more than 350-grams of U-235 per package and no more than 5 grams of U-235 in any 10 liters of package; or, no more than 50-grams of U-235 per container and no more than an average of 5 grams of U-235 per 10 liters of package – provided that:

- Each such area qualifies for appropriate nuclear isolation with respect to other areas where SNM is more concentrated.

The limits established above represent values that are below the maximum subcritical limits as established in numerous technical references, including LA-12809, ARH-600, LA-10860, ANSI/ANS-8.1(2014), and the limits presented in the *Handbook for the Conduct of Nuclear Criticality Safety Activities at the Columbia Fuel Fabrication Facility.* These limits apply to all aspects of the operation, including expected upset conditions.

Storage areas in which the only SNM present is contained in authorized packages as defined in 49CFR173 – provided that:

- The maximum number of containers permitted in each such area shall be unlimited for low specific activity packages.
- The maximum number of packages bearing FISSILE labels stored in any one storage area must be limited so that the total sum of the criticality safety indices in any individual group of such packages does not exceed 100. Groups of such packages must be stored so as to maintain a spacing of at least 6m (20 feet) from all other groups of such packages.

### 12.2.4 Exemption From Physician Approval to Use Respiratory Protection Equipment

Notwithstanding the requirement of 10CFR20.1703(c)(5) to use a physician to determine that an individual user is medically fit to use respiratory protection equipment, the licensee may use a nurse practitioner under the supervision of a physician to make this determination.