R2/E32
3-4-00

Mr. Robert A. Williams
Licensing Project Manager
Commercial Nuclear Fuel Division
Westinghouse Electric Company
Drawer R
Columbia, South Carolina 29250

SUBJECT: 19 REVIEWS FOR SAFETY CONDITION S-2 (TAC NOS. L31095, L31096, L31110, L31138, L31181, L31188, L31201, L31210, L31211, L31212, L31213, L31214, L31215, L31240, L31251, L31262, L31263, L31264, AND L31297)

Dear Mr. Williams:

In accordance with your submittals by letters dated July 31, August 12 and 31, September 3 and 15, October 30, 1998; January 11, March 31, April 30, May 14, June 30, July 1, August 31, September 30, 1999; and January 7, 2000, and pursuant to Part 70 to Title 10 of the Code of Federal Regulations, Materials License SNM-1107 is hereby amended to revise Safety Condition S-2.

Accordingly, Safety Condition S-2 has been revised to read as follows:

S-2 Criticality Safety Evaluations (CSEs) and Criticality Safety Analyses (CSAs) will define the interim criticality safety bases utilized throughout the CFFF. All CSEs/CSAs will be upgraded and/or completed in accordance with all applicable commitments in Chapter 6.0 of the License Application and all other regulatory requirements. Summaries of the CSEs/CSAs (in the format of License Annexes) will be submitted to NRC for review and approval. All completed CSEs/CSAs will be independently peer-reviewed in accordance with all applicable regulatory requirements and related procedures. Configuration control data packages for ongoing changes to facility structures, systems and components, and controls will be filed with their respective CSEs/CSAs to provide a substantially complete "living" framework for system Integrated Safety Assessments (ISAs) that will ultimately become the Final CFFF Design Safety Basis described in Chapter 4.0 of the License Application.

I-6

All other conditions of this license shall remain the same. Enclosed are copies of the revised Materials License SNM-1107 and the Safety Evaluation Report, which includes the Categorical Exclusion determination. If you have any questions regarding this licensing matter, please contact the Project Manager, Harry Felsher, of my staff at (301) 415-5521 or by e-mail at HDF@NRC.GOV.

Sincerely,

Eric J. Leeds, Acting Chief
Licensing and International
Safeguards Branch
Division of Fuel Cycle Safety
and Safeguards, NMSS

Docket 70-1151
License SNM-1107
Amendment 22

Enclosures: 1. Materials License SNM-1107
2. Safety Evaluation Report

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Docket 70-1151	PUBLIC	NRC File Center	NMSS r/f	FCSS r/f
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DOCKET: 70-1151

LICENSEE: Westinghouse Electric Company LLC (WELCO)
Columbia, SC

SUBJECT: SAFETY EVALUATION REPORT: 19 REVIEWS FOR SAFETY CONDITION S-2 IN SUBMITTALS DATED JULY 31, AUGUST 12 AND 31, SEPTEMBER 3 AND 15, OCTOBER 30, 1998; JANUARY 11, MARCH 31, APRIL 30, MAY 14, JUNE 30, JULY 1, AUGUST 31, AND SEPTEMBER 30, 1999; AND JANUARY 7, 2000

BACKGROUND

By letters dated July 31, August 12 and 31, September 3 and 15, October 30, 1998; January 11, March 31, April 30, May 14, June 30, July 1, August 31, and September 30, 1999; and January 7, 2000, WELCO submitted documents for the Westinghouse Commercial Fuel Fabrication Facility to fulfill the commitment in Safety Condition S-2. By letter dated November 25, 1997, the Nuclear Regulatory Commission (NRC) sent a request for additional information (RAI) to WELCO. On January 28, 1998, following discussions at a meeting between the NRC and WELCO on January 9, 1998, NRC withdrew the RAI pending site visits to determine the adequacy of documentation and whether substantive reviews could be conducted onsite. NRC staff visited the site in January and March 1998. Following the visits, NRC determined that additional information needed to be submitted and sent a second RAI on June 26, 1998. WELCO responded to the second RAI in a letter dated July 24, 1998. NRC staff performed technical and programmatic reviews of Integrated Safety Assessment (ISA) and Criticality Safety Evaluation (CSE) License Annexes to determine if WELCO had met the requirements of Safety Condition S-2 for 19 systems.

DISCUSSION

Safety Condition S-2 requires WELCO to submit for NRC nuclear criticality safety (NCS) review the ISA License Annexes for higher-risk systems and either an ISA or CSE License Annex for other systems. The basis for designating a system as higher-risk was an NRC determination that the system involves either a high quantity of material in powder form or contains processing steps having a large availability of moderation. NRC staff reviewed the systems in the submittals and agreed with WELCO that the four higher-risk ISA License Annex systems were: ADU Bulk Powder Blending, ADU Conversion, UN Bulk Storage, and URRS Safe Geometry Dissolver. The other systems were of lower-risk. The lower-risk ISA License Annex systems were: Chemicals Receipt, Handling, & Storage and Plant Ventilation. The lower-risk CSE License Annexes were: ADU Fuel Rod Manufacturing, ADU Process Pelleting, Cylinder Washing, Final Assembly, Hoods and Containments, IFBA (Excluding Rods), IFBA Fuel Rod Manufacturing, Laboratories, Low Level Radioactive Waste Processing, Scrap Uranium Recovery Processing, Solvent Extraction, Storage of Uranium Bearing Materials, URRS Waste Treatment.

A WELCO CSE for a system has two sections: Process Summary and NCS Controls & Fault Trees. A WELCO ISA for a system has four sections: Process Summary, Environmental Protection & Radiation Safety Controls, NCS Controls & Fault Trees, and Chemical Safety & Fire Safety Controls. For a given system, the sections on Process Summary and NCS Controls & Fault Trees are the same in both the CSE and ISA.

NRC staff performed a technical review of the higher-risk ISA License Annexes for those four systems and performed a programmatic review of the lower-risk ISA and CSE License Annexes for the other 15 systems. The sections that follow describe the staff's review of those systems. The reviews for each of the four higher-risk systems begin on the following pages: ADU Bulk Powder Blending on page 2, ADU Conversion Process on page 6, UN Bulk Storage on page 20, and URRS Safe Geometry Dissolver on page 20. The review for the other systems is on page 22.

ADU BULK POWDER BLENDING

The UO_2 powder from an ADU conversion line is analyzed for certain chemical and physical properties, including percent H_2O, prior to blending. Established Process and Chemical Area Manufacturing Process System (ChAMPS) limits determine which polypaks are rejects and which polypaks are to be blended together. The final blended UO_2 powder also has to meet chemical properties. A homogenous, fabricable, and acceptable powder blend for the pellet area is expected.

The Bulk Blending Room is located in the Chemical Area. Major equipment in the room consists of two dump hood stations, one consolidation station, two remill stations, one tumble blender, one bulk container cleaning station, one feeder valve assembly cleaning hood, and one cover plate cleaning/storage hood.

The Bulk Blending Room is maintained as a Moderation-Controlled (MODCON) Area.

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The stages of the ADU Bulk Blending System are: (1) Bulk Container Material Feed, (2) ADU Bulk Blending Process, and (3) Miscellaneous Operations in the Bulk Blending Area.

Bulk Container Material Feed

The ADU bulk containers are used to blend UO_2 or U_3O_8 separately for the purpose of obtaining a homogenous powder with uniform chemical and physical properties. Process and ChAMPS established limits determine which polypaks are rejects and which polypaks are to be blended together. Polypaks of the same enrichment are blended together and polypaks of different enrichments may be blended together to obtain a desired enrichment. Blended powder may be added to another bulk container as an enrichment blending ingredient.

Bulk containers receive UO_2 from the conversion of UF_6 or uranyl nitrate in ADU lines. Powder produced from ADU conversion lines is stored in favorable-geometry polypaks. The polypaks are loaded onto specially designed storage carts to maintain the required spacing between polypaks.

Bulk containers also receive U_3O_8 clean scrap for recycle (addback to the UO_2 product stream).

In the ADU conversion and pelleting processes, clean addback U_3O_8 is produced by oxidation of hardscrap (sintered pellets), sintered green scrap (from reject UO_2 powder and green scrap), and grinder sludge or grinder swarf. Item Control System (ICS) established limits determine which polypaks of U_3O_8 are suitable for blending as pellet addback. [Note that ICS will eventually be replaced by ChAMPS.]

ADU Bulk Blending Process

The ADU blend cycle involves powder transfers from one container to another with the purpose of powder homogenization. The following processing equipment are used: Polypak Dump Hood Stations, Bulk Container Tumble Blender, Remilling Stations, Consolidation Station, Quality Control Sampling/Dump Hood Stations.

Polypak Dump Hood Stations

In the MODCON Area, there are two stations for transferring material from polypaks to bulk containers. The new Bulk Blending Sample Station and Polypak Dump Station for UO_2 powder, referred to as Dump Station No. 2, is equipped with engineering safeguards and systems for performing ChAMPS transactions. The old dump station, referred to as Dump Station No. 1, is used exclusively for U_3O_8 powder. This station does not have ChAMPS system safeguards, but utilizes ICS transactions for blend surveillance.

Ex 4

As a MODCON Area safeguard, all ChAMPS and ICS transactions of polypaks or carts selected for bulk blending are processed only if [redacted] Specific UO_2 polypaks are designated for a particular blend based on some chemical and physical properties. ChAMPS-acceptable UO_2 powder has the following characteristics: [redacted]

A blend/remilling strategy established by Chemical Process Engineering (CPE) further limits the UO_2 blend makeup into more restrictive ranges of surface area (BET) and averaged blend properties. Polypaks of powder identified on ChAMPS/ICS picklist and of acceptable moisture are gathered on a cart. ChAMPS and ICS transactions are used for moving selected polypaks to the MODCON Area.

At the Polypak Dump Hood Station, a bulk container is placed under the ventilated hood. Two operators inspect the bulk container for cleanliness. When all polypaks are dumped, cleanup is performed and the bulk container is closed. The bulk container is weighed and the weight is compared with the ChAMPS or ICS blend weight.

Bulk Container Tumble Blender

The electric tumble blender is designed with a 5:1 load safety factor, sufficient to handle the combined maximum gross weight of the container and powder blend. The tumble blender consists of separate clamping and rotating drive systems. The rotating drive system has a gearbox that contains 5.9 liters of oil. The blender is located in a fenced enclosure with an electrically interlocked sliding gate for personnel safety protection. There is a manual safety gate and lock pins to provide redundancy for the clamping mechanism.

The blender control logic utilizes a Programmable Logic Controller (PLC) control system. Fail-safe operation sensors provide inputs to the PLC that are used for control functions and interlocks. The control logic insures that the operator perform the load, blend, and unload functions in the correct order. The normal blend cycle is to slowly accelerate to 10 rpm, rotate for a total of 160 revolutions, decelerate, and stop. The tumble blender is also used to loosen up powder in the bulk container prior to transferring the powder out by tumble blending for 10 or more revolutions.

Remilling Stations

UO_2 product is milled at the end of the conversion lines. However, a majority of blended powder is remilled to breakup agglomerates as well as larger particles to improve subsequent pellet quality, which is done in the Bulk Blending Area. The CPE engineer identifies UO_2 blends that need remilling based on ChAMPS-calculated blend average surface area (BET). Powder with high surface areas are not remilled because of possible "burnback" at the mill. "Burnback" is when fine particles of UO_2 powder rapidly oxidize to U_3O_8 when exposed to air at elevated temperature. Blended powder that has been remilled will exhibit an increase in surface area and bulk density. Remilling also shifts the particle size distribution to an overall finer powder. There are two remill stations. Remill Station No. 1 and No. 2 can only be assigned to process one enrichment at a time. If a different enrichment is to be remilled, the station undergoes enrichment cleanout.

A bulk container is placed under the mill outlet and positioned to receive remilled powder. The bulk container full of blended UO_2 powder to be remilled is fitted with a feeder valve assembly that controls the feed to the mill. Nitrogen purges are used to alleviate the risk of powder "burnback" during remilling. A blend that is remilled is weighed and re-tumbled another 160 revolutions to homogenize residual powder from the remill operation.

Consolidation Station

A U_3O_8 blend is normally transferred into polypaks after blending for use in the Pellet Area. UO_2 normally stays in the bulk container. For enrichment blending, either blended UO_2 or U_3O_8 may be transferred to polypaks. As the polypaks are created, ChAMPS or ICS assigns the blend lab results including moisture values to the polypaks.

The bulk container with blended powder is fitted with a feeder valve assembly at the Cover/Feeder Station and then positioned at the consolidation station above the polypak loading hood. Polypak filling may proceed when bulk container sealing and feeder vibrator and valve airlines are connected and polypak positioning controls are actuated. When the polypak is full, a high level cut-off probe stops the fill cycle by stopping air to the feeder vibrator and closing the polypak loading hood valve. If the level or weight of the powder in the downloaded polypak needs to be adjusted, the level probe may be rotated to the desired position. Powder carts with polypaks are removed from the MODCON Area as soon as practical.

Quality Control Sampling Station/Dump Hood Stations

At the polypak dump hood stations, the bulk container to be sampled is positioned cone-end up. The cover plate is removed and the dump hood is lowered to the bulk container. Using a clean sample thief, the operator samples the bulk container. Four samples are taken from four different locations for chemistry purposes and a total of ten samples are taken for enrichment. If pre-production polypaks are required, a long handed scoop is used. After samples are taken, the container is closed, the container is reweighed, and the item is created in ChAMPS or ICS.

If the blend was transferred into polypaks at the Consolidation Station, the first polypak is sampled to ensure that no U-235 enrichment degradation occurred. If the bulk container is transferred to polypaks before sampling, Quality Control (QC) samples other polypaks at random prior to blend release and QC checks for any foreign material or any unusual appearance.

Miscellaneous Operations in the Bulk Blending Area

The following operations are conducted in the MODCON Area to support the primary bulk blending and powder transfer operations:

A Bulk Container cleaning station is available for use when an appreciable amount of powder is present. The empty bulk container is placed cone-end up on the station platform and the container is cleaned using a scoop, brush, or vacuum.

A Feeder Valve Assembly Cleaning Station is available. A transfer cart is used to move a feeder valve assembly between stations. A jib crane located at the feeder valve storage area is used to move a feeder valve assembly from the transfer cart or storage rack to the specially-designed hood. The hood enables the operator to clean both sides of the assembly and collect the powder at the bottom of the hood into a polypak.

The Cover/Feeder station is designated for operations such as installing and removing a feeder valve assembly from containers and removing and installing bulk container covers. Two vent hoses are positioned near the opening of the container to provide some ventilation when the container is open. An overhead crane is provided to lift the feeder valve assembly and to move bulk containers to and from the top of the Remill station. If the feeder valve assembly is to be used on bulk containers going to the Pellet Area, a "fast-feeder" having larger openings is used.

When a bulk container is returned to the MODCON Area from the Pellet Area, the bulk container with feeder valve assembly is weighed and the residual powder calculated. If material is present, it is either returned to the Pellet Area, created in ChAMPS as an item, or cleaned out. When the feeder valve assembly is removed, the operator inspects the inside of the container to remove any moderator or foreign material. Then the bulk container cover is installed and the container is stored until needed for the next blend. Dirty covers are cleaned and stored in the Cleaning/Storage Hood.

A lift truck with a hydraulic clamping device is used to rotate containers with cone-end up or down and to move containers within the Bulk Blending Area. Two motorized pallet trucks are available to move the bulk container to and from the tumble blender, to the Pellet Area, or to the storage area. The floor scale used for bulk container weighing after tumbling, remilling, and sampling is weight checked once per day with appropriate weight standards. An adjustable electro-hydraulic operated lift platform is located directly in front of the dump station. This movable platform provides an ergonomic working level for the operator when off-loading polypak carts and placing polypaks in the dump hood. An adjustable electro-hydraulic operated lift table for lifting polypak carts is anchored in front of Dump Station No. 2 and beside the operator working platform.

WELCO has passive-engineered controls [redacted]

Ex. 4

In a controlled study, documented in a TV video, WELCO NCS staff placed increasing amounts of water mixed with UO_2 powder to ascertain visual and other characteristics. During the study, moisture levels of 10-15 wt.% were readily noticeable visually. NRC personnel viewed the video and agreed that it is readily apparent when polypaks have moisture levels above 10-15 wt.%. The measurement technique used during operations was shown to be able to detect one defective polypak (i.e., high moisture content) in a 56-polypak composite sample if the defect is greater than 8.3 wt.% moisture and the remaining polypaks are 0.155 wt.% moisture. The normal operating condition is less than 0.3 wt.% moisture.

The staff has reviewed the nuclear criticality safety for ADU Bulk Blending and concludes that the parameter that directly affects neutron multiplication is moderation. Limits and assumptions have been established to prevent the introduction of moderator in the bulk container. A criticality would be possible if: [redacted] *The staff has reviewed the accident scenarios and controls used to prevent the accident scenarios and agrees that the commitment to prevent the introduction of moderator and the measures taken to preclude fissile solutions from occurring are sufficient to ensure that multiple failures are required before a nuclear criticality is possible. Therefore, the staff concludes that there is reasonable assurance that a nuclear criticality will not occur in ADU Bulk Powder Blending.*

Ex. 4

ADU CONVERSION PROCESS

The multi-staged ADU Conversion process is designed to convert UF_6 into ceramic grade UO_2 powder. During this process, two broad categories of off-stream uranium-bearing solids are generated. They are referred to as "clean scrap" and "dirty scrap." The uranium that is collected as scrap throughout the manufacturing process is dissolved in nitric acid, producing an intermediate uranium product, $UO_2(NO_3)_2$, abbreviated UN. The UN is eventually converted to a usable UO_2 powder during the same ADU conversion process as for UF_6.

All the operations of the ADU Conversion System take place in one of five ADU conversion lines. UF_6 gas can be processed on Lines 1, 2, 3, and 4. The vaporizers and hydrolysis column of Line 5 are "tagged out" and physically isolated from the rest of the system. UN can currently be processed on Lines 1 and 5, although Lines 2, 3, and 4 could be modified for UN processing. Scrap materials can be processed on all lines, however, they are most commonly processed on Line 5.

A Total Distributed Control System provides individual system Proportional-Integral-Derivative (PID) loop control for output signals from process parameter transmitters. Visual and audible alarm indicators are provided for all PID loops. Additionally, the output signals from field process parameter transmitters are sent, either directly to or through the Total Distributed Control System, to a Programmable Logic Controller (PLC), which provides visual and audible alarming and interlock functions for safety protection.

ADU Conversion process equipment is designed to maintain "geometry control" for material enriched to less than 5 wt.% U-235 or less in order to prevent an accidental criticality. The ADU Conversion process essentially consists of the following major steps:

1. heating cylinders containing solid UF_6 enriched up to 5% U-235 in a steam-heated vaporizer to produce gaseous UF_6,

2. hydrolyzing the gaseous UF_6 with water in a hydrolysis column to produce uranyl fluoride (UO_2F_2) solution and hydrofluoric acid (HF),

3. precipitating ADU by combining the UO_2F_2 with ammonium hydroxide (NH_4OH) in a precipitator column,

4. separating and dewatering the precipitated ADU using a centrifuge,

5. drying the dewatered ADU using a jacketed hot oil dryer, and

6. applying heat to the dried ADU by using a calciner to produce U_3O_8, which is subsequently reduced to UO_2 in an atmosphere consisting of nitrogen, hydrogen, and steam.

Cylinder

UF_6 is received from an enrichment facility supplier in Model 30B cylinders. These are vertical non-favorable geometry cylinders, which, during normal operations, contain multiple critical masses of UF_6 and no moderator. If a cylinder meets required mass, enrichment, and impurity criteria, it may be readied for processing. After sampling, these cylinders are individually weighed and transferred to storage racks at the UF_6 storage pad to await further processing in ADU conversion. With the use of special equipment, a Model 8A cylinder may also be installed for processing.

When needed, a UF_6 cylinder is transferred by crane from its storage rack and loaded into a steel vaporizer steam chest. A flexible copper pigtail is installed to connect the cylinder discharge valve to the UF_6 discharge line inside the vaporizer, which enables the UF_6 to flow from the cylinder to the hydrolysis column in the ADU conversion system. Before UF_6

processing, a nitrogen purge is established from the pigtail up to the hydrolysis column through the UF_6 supply line to ensure that no leaks exist. Manual cylinder valve operators are provided for externally-controlled opening and closing of the cylinder valves during conversion processing.

Vaporization

Vaporization is the process whereby UF_6 is vaporized from a solid to a gas for hydrolysis processing. Under normal conditions, the UF_6 is heated to an approximate temperature of 240-250°F for vaporization; and is controlled by maintaining the chest steam pressure in the 11-14 psig range. Cylinder discharge pressure and steam chest pressure is monitored. At designated high and low chest pressures,

Pressure in the UF_6 supply header from the vaporizers to the hydrolysis column V-X02 is also monitored. If the cylinder discharge pressure exceeds a designated setting,

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An even higher cylinder pressure will

In addition to these engineered controls, each vaporizer has two pressure relief valves in parallel that relieve at a suitable factory-set pressure.

The pressure in the supply header is also monitored for low pressure to prevent

Temperature in the UF_6 supply line to the hydrolysis column is monitored. When the supply line temperature drops below a prescribed setting, an interlock activates to close the main flow control valve and the safety shut-off valve in both the eduction and UF_6 piping. Nitrogen used to purge the UF_6 and eduction piping is heated with heater H-X-01. Nitrogen temperature is monitored and the power supply to the heater is terminated if the temperature rises above a designated setting.

In the event of a system leak, the UF_6 may collect in the steam chest. Gaseous UF_6 released inside the chest reacts with the steam or atmosphere moisture to form HF gas and particulate UO_2F_2, which tends to settle on surfaces. The nuclear material would discharge from the vaporizer with normal condensate flow and activate

Ex. 4

Eduction

The Vaporization process converts UF_6 to a gas for transport to the hydrolysis columns. The UF_6 remaining the cylinder after processing must meet weight and pressure requirements for off-site shipment. The vaporizer may also be used for cylinder eduction to remove as much residual UF_6 as possible. If the weight requirement is met, the cylinder is allowed to cool and then vacuum checked to verify pressure. Cylinders passing the vacuum check are released to storage following handling and clearance by Regulatory Engineering & Operations. Cylinder eduction is repeated as needed to remove residual UF_6.

Cylinder eduction is typically signaled when the pressure of an open-line cylinder drops to around 20 psig along with a marked drop in hydrolysis column temperature. The "heel cylinder" is then valved off and a standby cylinder is valved on. Once the hydrolysis column temperature has stabilized around the operating set-point, the eduction piping is purged with nitrogen to verify that the eduction lines and nozzle are not plugged. A full pressure N_2 flow prescribed rate is initiated to the eductor. The automatic UF_6 flow control valve is then placed in manual control mode and the "heel cylinder" is valved on-line for eduction. As the N_2 passes through the eductor, a vacuum is created in the piping between the eductor and the cylinder; residual UF_6 in the "heel cylinder" is drawn into the hydrolysis column. The automatic UF_6 flow control valve is returned to automatic control mode when the temperature of V-X02 stabilizes at near set-point. Cylinder eduction is continued until the educting cylinder pressure drops to a low value which typically takes 1-2 hours. N_2 flow is continued for several minutes to evacuate the pigtail and UF_6 eduction piping. To protect against [ ] Cylinders may also be educted apart from UF_6 processing.

Because the mass of uranium in the UF_6 non-favorable geometry cylinder is of sufficient quantity, a nuclear criticality is possible if sufficient moderator is available and if a means exists for moderator to enter the cylinder. The two accident scenarios that would cause this criticality are the following: [ ]

The accident scenarios discussed above that could initiate a nuclear criticality in a cylinder housed in a vaporizer are all predicated on [ ] *The staff reviewed the accident scenarios and controls*

Ex. 4

used to prevent the accident scenarios. The use of multiple active-engineered controls, multiple process controls, and multiple administrative controls preclude

The staff agrees that these controls are sufficient to ensure that the possibility of a nuclear criticality requires multiple failures in the UF_6 cylinder and

Therefore, the staff concludes that there is reasonable assurance that a nuclear criticality will not occur in a cylinder in a vaporization chest.

<u>Hydrolysis</u>

UF_6 from the vaporization process enters the favorable geometry hydrolysis column V-X02 where it reacts with deionized (DI) water and recirculated solution to form UO_2F_2 solution and HF is produced as the byproduct. UF_6 gas enters the column through a nozzle in a cross spool above the solution reservoir section and rises through the column section filled with Tellerette packing, reacting with DI water and recirculated solution. The nozzle has two ports, one for normal UF_6 feed and one for UF_6 eduction feed, that are fitted with piston valves to clear possible blockages of crystalline UO_2F_2 solution. UO_2F_2 solution generated in the hydrolysis process collects in the bottom reservoir of V-X02. A specified portion of the solution is pumped through an automatic flow control valve to the Precipitator (V-X05), while the rest is recirculated into V-X02 through a spray nozzle positioned above the packing.

Controls are provided to stop UF_6 flow in the event of

A vent line is provided for V-X02 to evacuate rising vapors that result from the hydrolysis reaction. Nitrogen used during the eduction and purging operations is also evacuated. These gases and vapors are sent to a scrubber (2A/2B) where they can be safely handled and treated. The vent system is composed of two parallel headers that traverse the ADU conversion lines with interconnecting pipes between conversion lines and valving that allows flushing of individual column lines. The dual headers permit venting and flushing simultaneously. A vessel (V-406B) is provided to serve as reservoir for the wash water circulated through the vent header being cleaned. The solution may be pumped to either the header or to Scrap Reprocessing.

The hydrolysis column is favorable geometry for optimally moderated fluorides with partial water reflection. The column has active-engineered and process controls for concentration control. Multiple, independent active-engineered controls provide for control of

The staff has reviewed the nuclear criticality safety for the hydrolysis column, including the accident scenarios and controls used to prevent the accident scenarios, and concludes that the licensee's commitments to provide favorable geometry vessels and to provide reasonable assurance that a nuclear criticality will not occur.

Ex. 4

Uranyl Nitrate ($UO_2(NO_3)_2$) Feed Preparation

UN is produced by dissolving scrap UO_2 in nitric acid. Excessively "dirty" scrap material undergoes a solvent extraction process while being converted to UN. The UN is then pumped to a storage column (V-X06A) on the ADU conversion line. From there, it is fed directly into the precipitator (V-X05) where it is precipitated with ammonium hydroxide to form ADU. From the precipitator on, the process differs from the UF_6 conversion process only by the set-points of the process parameters.

The mixing of UN with HF is called "spiking." An automated batch spiking station uses a 240 gallon mixing tank (T-1280) having controls for blending HF and UN by weight. The HF and UN are transferred from their respective outside bulk storage facilities. Pumps are provided for system recirculation and discharge. Recirculated liquid enters the tank through an eductor to keep the tank contents well mixed. The spiking station is within a ventilated enclosure and a dike spill containment is provided. Alarm conditions that ensure process safety are the following:

The spiked solution is pumped to the process surge tank (V-X06A) on the conversion line designated for UN processing. The V-X06A vessel is equipped with pumps for solution transfer to the precipitation process. Solution not pumped to the precipitator is recirculated into V-X06A.

The nitrate feed tank is favorable geometry for optimally moderated uranium oxides with partial water reflection. The feed streams to the tank have active-engineered, administrative, and process controls for

The staff has reviewed the nuclear criticality safety for the nitrate feed tank, including the accident scenarios and controls used to prevent the accident scenarios, and concludes that the licensee's commitments to provide favorable geometry vessels and to provide reasonable assurance that a nuclear criticality will not occur.

Precipitation

The precipitation of ADU is carried out in a vessel (V-X05) with strategically positioned inlet nozzles and pump recirculation. The temperature of the reaction solution is maintained at prescribed settings. A prescribed portion of the solution passes through an automatic flow control valve to a centrifugal separator (D-X07) while the rest is recirculated through a heat exchanger (HX-X05C) and returned to V-X05.

Under normal conditions, ADU is precipitated by a large excess of ammonia from the solutions of uranyl fluoride and hydrogen fluoride as well as from a solution of uranyl nitrate with free nitric acid and hydrogen fluoride. Differences in the precipitation of uranyl fluoride and uranyl nitrate solutions lie in their different feed concentrations, feed rates, impurity levels, and reaction by-products. Controls are provided to avoid wide variances in uranium and NH_4OH concentrations, recirculation flow, and changes in solution temperature that can affect precipitate properties, and resultant settling and fouling characteristics. When conditions of excessive fouling occurs, as evidenced by reduced recirculation flow, the precipitator is cleaned using nitric acid solution. The resultant uranyl nitrate solution is transferred to the V-X06A where it is staged for processing through the precipitator using normal process parameters. This acid washing is also done a times of extended shutdown or contract completion, as deemed necessary. The V-X05 pumps are stopped if there is either a loss of flow in the discharge piping or a low tank level.

EX. 4

The precipitator is favorable geometry for optimally moderated uranium oxides with partial water reflection. The feed streams to the precipitator have active-engineered, administrative- and process-controls.

The staff has reviewed the nuclear criticality safety for the precipitator column, including the accident scenarios and controls used to prevent the accident scenarios, and concludes that the licensee's commitment to provide favorable geometry vessels, provide reasonable assurance that a nuclear criticality will not occur.

Dewatering - Decanter

Decanter and Tank V-X19

The ADU precipitate is separated by a centrifugal separator (i.e., decanter or centrifuge) (D-X07) to form a slurry. The solids from D-X07 discharge to a favorable geometry slab receiver tank (V-X19). Here, the solids are conveyed by a paddle-type auger (K-X19) to a progressing cavity pump (P-X19), which also provides some mixing in the tank. Pump P-X19 moves the ADU slurry from V-X19 to a hot oil dryer (DR-X25) for further dewatering. The action of pump P-X19 is controlled to maintain the level in V-X19 at a specified setting. The slurry solids consistency level is maintained within a range to accommodate pumping and machine discharge by the metered addition of DI to the decanter discharge breech. The decanter is also used to recover uranium oxide solids carried into the calciner off-gas scrubber (S-X31) by reactant and by-product gases from the calcination process. When all required operating conditions have been met, the controlled flow of oxide-bearing scrubber solution to the decanter is initiated. The oxide stream ties into the ADU feed line to D-X07.

[redacted] Ex. 4

Nuclear criticality safety in the decanter and in tank V-X19 is assured by commitments to control [redacted] The staff reviewed the accident scenarios and controls used to prevent the accident scenarios. The use of multiple process controls and multiple administrative controls prevent [redacted] The staff agrees that these controls are sufficient to ensure that the possibility of a criticality requires multiple failures [redacted] Therefore, the staff concludes that there is reasonable assurance that a nuclear criticality will not occur.

Decanter Liquid Discharge Receiver Tank V-X12

The liquid centrate discharges D-X07 to a favorable geometry receiver tank (V-X12). Condensate from dryer off-gas condenser (CO-X26) is also routed to this tank. Solution from liquid effluent receiver tank (V-X12) is also used to make-up solution for S-X31 when operating in uranium recycle mode. The V-X12 pumps are stopped if there is either a loss of flow or a low tank level. The tank V-X12 is favorable geometry for optimally moderated uranium oxides with partial water reflection. The feed streams to the tank have active-engineered, administrative, and process controls for concentration control.

The normal condition is trace amounts of uranium oxides. Under [redacted]

The staff has reviewed the nuclear criticality safety for the decanter liquid discharge receiver tank V-X12, including the accident scenarios and controls used to prevent the accident scenarios, and concludes that the licensee's commitments to provide favorable geometry vessels and to [redacted] provide reasonable assurance that a nuclear criticality will not occur.

Decanter Purge Drain Tank V-X20

DI purges exist on both the bowl housing and the feed end bearing to provide cleaning and cooling. These purges discharge through separate lines to the small favorable geometry water purge collection tank (V-X20). Contents of V-X20 are pumped back into the feed stream of the decanter (D-X07) along with the primary feed stream. The main bowl of the decanter is driven by a motor. The decanter scroll is driven hydraulically by an oil-driven hydromotor. A hydraulic drive-pump unit feeds the oil to the system hydromotor. The control oil pressure is set to ensure a differential speed sufficient to reliably discharge solids from the decanter bowl. Both high and low pressure interlocks exist for the hydromotor to prevent

Ex. 4

The decanter purge drain tank V-X20 is favorable geometry for optimally moderated uranium oxides with partial water reflection. For normal operating conditions with optimal moderation and partial water reflection, the k-eff is ≤ 0.73. For an increase in tank thickness with optimum moderation and full water reflection, the k-eff is ~0.90.

The staff has reviewed the nuclear criticality safety for the decanter purge drain tank V-X20, including the accident scenarios and controls used to prevent the accident scenarios, and concludes that the commitment to provide favorable geometry vessels and provide reasonable assurance that a nuclear criticality will not occur.

Dewatering -Dryer

Dryer Bag Filter FL-X29

Uranium solids collected from the decanter in V-X19 are pumped by P-X19 into dryer DR-X25 for further dewatering. DR-X25 is a surface heated hot oil dryer, approximately 10.25 inches in diameter by 11 feet long. ADU slurry enters the dryer and is moved along the inner wall of the dryer tube by a rapidly rotating paddle auger. This produces a reduction in the volatiles content of the ADU from around 40 percent to approximately 3 percent. Off-gases exit the dryer through a bag filter house where most of the entrained particles are removed. The dryer filter bags are blown down with heated nitrogen. The off-gases are drawn from DR-X25 by exhaust fan FN-X27 located downstream of the dryer off-gas condenser (CO-X26). The volatiles are condensed and discharged to the liquid discharge receiver tank (V-X12). The gases and vapors from both the dryer and V-X12 are routed to the Conversion Area air effluent treatment system. The dried material is discharged from the dryer into a bucket elevator (EL-X27) for transfer to the calciner (C-X09) located on the platform above the dryer. The dryer bag filter FL-X29 is favorable geometry for optimally moderated uranium oxides with partial water reflection. For the filter and housing filled with optimally moderated UO_2-H_2O and fully water reflected, the k-eff is 0.95.

The staff has reviewed the nuclear criticality safety for the dryer bag filter FL-X29, including the accident scenarios and controls used to prevent the accident scenarios, and concludes that the commitment to provide favorable geometry control is sufficient to provide reasonable assurance that a nuclear criticality will not occur.

Hot Oil Dryer

During normal operations, the favorable geometry hot oil dryer receives an overmoderated

ADU-UO_2 slurry from the decanter storage tank V-X19, drives the slurry through optimum moderation, and pumps undermoderated ADU-UO_2 to the bucket elevator for transport to the calciner. Heat is supplied to the dryer wall by hot oil which flows through a jacket surrounding the dryer tube. The oil is heated in one of two hot oil systems and pumped to the dryers. Two automatic valves are in place to regulate flow of oil to the dryer on some conversion lines. These valves allow/bypass hot oil in sufficient quantity to achieve an outlet oil temperature of approximately 530°F. The dryer is also equipped with a rotation sensor which stops the dryer shaft motor, the dryer feed pump, and the flow of hot oil to the dryer in the event that shaft rotation is lost. Power supply to the nitrogen heater for filter bag blow-back is also stopped after a prescribed time. The hot oil dryer is favorable geometry for optimally moderated uranium oxides with partial water reflection [ ]. [ ]

The staff has reviewed the nuclear criticality safety for the hot oil dryer, including the accident scenarios and controls used to prevent the accident scenarios, and concludes that the commitment to provide favorable geometry vessels and [ ] provide reasonable assurance that a nuclear criticality will not occur.

Ex. 4

Calcination

Bucket Elevator and Enclosure

ADU/oxide powder that discharges from the dryer (DR-X25) falls into the elevator (EL-X27) that is oriented to transport the powder to the chute that connects the elevator and the calciner feed system. The bucket elevator discharges powder to ta set of N_2 purged rotary duplex valves (K-X09C). The duplex valves feed the dried ADU/oxides to the rotary calciner feed screw (K-X09A). A N_2 purge to the duplex valves exists to prevent air from the dryer/elevator/recycle feeder system from mixing with the H_2 from the calciner. An interlock exists on the duplex valves to prevent operation if the calciner feed screw drive motor is not on. Also, an interlock stops the N_2 purge to the duplex valves in the event that the duplex valves' drive motor stops.

The elevator housing is [ ]

The staff has reviewed the nuclear criticality safety for the elevator housing, including the accident scenarios and controls used to prevent the accident scenarios, and concludes that the commitment to provide geometric control is sufficient to provide reasonable assurance that a nuclear criticality will not occur. The staff has reviewed the nuclear criticality safety of the elevator access enclosures, including the accident scenarios and controls used to prevent the accident scenarios, and concludes that the commitment to control [ ] the geometry of the fissile material by [ ] is sufficient to ensure that multiple failures are required before a nuclear criticality is possible. Therefore, the staff concludes that the licensee has provided reasonable assurance that a nuclear criticality will not occur.

Calciner

The calciner system consists of a geometry-controlled cylindrical calciner tube housed inside an unfavorable geometry cylindrical combustion chamber. During normal operation, the combustion chamber contains neither fissile material nor moderator. The calciner rotary feed screw conveys ADU/oxide powder into the calciner (C-X09) which is a cylindrical calcining furnace consisting of a rotating tube inside a combustion chamber. Inside the calciner, ADU is reduced to UO_2 in a hydrogen atmosphere and steam is added to strip away residual fluoride contamination.

The calciner is heated by a series of burners fueled by natural gas. Effluent gases from the calciner combustion chamber are vented to the roof. Pressure in the calciner combustion chamber is controlled using a damper at the exit port of the vent stack and either a regulated cool air purge or a direct pressure control valve (Line 3). Two safety shut-off valves isolate the burners' natural gas supply from the calciner under several interlock conditions (e.g., "calciner flame-out"). Operators have several methods to flame-out the calciner. When a calciner is flamed-out, audible and visual alarms are received in the Control Room. When the alarms sound, both natural gas safety shut-off valves are automatically closed and the solenoid vent valve is opened to vent any gas trapped between the shut-off valves. The temperature inside the combustion chamber is sensed by thermocouples located at approximately the same points along the length of the calciner as the burners.

Hydrogen and steam for the calcination process are added to the calciner at the discharge end and are drawn forward toward the off-gas exit port located at the feed end of the calciner. Quench and venturi nozzles in the scrubber, driven by the recirculation flow of calciner off-gas scrubber solution, provide the suction which draws the reactant and by-product gases through the system. Hydrogen and steam flows are regulated at prescribed rates and steam passes through a superheater (H-X09A) prior to entering the calciner. Seals exist on both ends of the calciner to separate the hydrogen-rich calciner atmosphere from the oxygen-rich environment.

Process pressure in the calciner is regulated by adjusting the water flow to the venturi section of the calciner off-gas scrubber, thus, regulating the suction generated and the pressure inside the calciner. If the calciner pressure deviates below or above the safe range that precludes both inleakage and outleakage of hydrogen, interlocks are activated to either introduce a nitrogen purge to the off-gas scrubber discharge piping for calciner due to low pressure or terminate hydrogen and steam flows to the calciner due to high pressure.

To protect the calciner tube from overheating in the event that tube rotation is lost, interlocks are activated to flame-out the calciner if power is lost to the drive motor, rotation is lost, or power to the three Acromag racks on each conversion line is lost. Before hydrogen flow is initiated to the calciner, the valve between the first and second discharge screws is closed to provide a seal for the calciner atmosphere in the absence of a powder seal. The calciner tube is geometry-controlled for optimally moderated uranium oxides with partial water reflection. The calciner combustion chamber is process-controlled to prevent a sufficient mass of uranium oxides and a sufficient volume of moderator to collect.

The staff has reviewed the nuclear criticality safety for the calciner tube, including the accident scenarios and controls used to prevent the accident scenarios, and concludes that the commitment to provide geometric control is sufficient to provide reasonable assurance that a *nuclear criticality will not occur. Because it is so unlikely that sufficient quantities of fissile material and sufficient volume of moderator would both be present in the combustion chamber, the staff has reasonable assurance that a nuclear criticality will not occur.*

Off-Gas Scrubbing

Reactant and by-product gases from the calciner (C-X09) pass through a heated vent line into scrubber S-X31 where uranium oxide powders are removed. Off-gas enters the scrubber through the calciner vent line, passes through a cross-over loop with venturi section, and exits through a jacketed condenser (CO-X31) to ventilation filters (FL-955 and FL-956).

The scrubber S-X31 is a favorable geometry slab tank with a series of pumps for solution recirculation. Off-gas scrubbing of entrained solids is achieved by contact with sprayed scrubber solution or DI. A portion of the scrubber solution is circulated through a heat exchanger (HX-X11) to control solution temperature. Some solution is circulated to promote tank solution mixing and solution flow to system spray nozzles provides off-gas scrubbing and steam quenching for calciner pressure control.

Two different methods are utilized to process solution from scrubber S-X31. Solution is either pumped through filtration devices and discharged to the quarantine tanks (filter press mode) or recycled to decanter D-X07 for on-line recovery of the calciner carry-over material (uranium recycle mode). Flow switches are provided for all scrubber system pumps to terminate power supply to the pumps if flow is not sensed.

Ex. 4

The tank is geometry-controlled for optimally moderated uranium oxides with partial water reflection. Active-engineered, administrative, and process-controls are in place to prevent a tank expansion. The tank has administrative and process-controls for uranium density.

The staff has reviewed the nuclear criticality safety of the calciner scrubber slab tank, including the accident scenarios and controls used to prevent the accident scenarios, and concludes that the commitments to maintain geometry control and to provide reasonable assurance that a nuclear criticality will not occur.

Calciner Off-Gas Vent Collection Pot Enclosure

The calciner off-gas vent collection system consists of a favorable geometry collection pot housed in an unfavorable geometry enclosure. During calciner operation, heavier solids, which are swept out of the calciner by the ventilation system, fall out of the ventilation stream into the vent pot. The vent pot enclosure provides airborne and contamination protection when the vent pot is replaced.

The calciner off-gas vent collection pot enclosure has active-engineered controls and process-controls to

The staff has reviewed the nuclear criticality safety for the enclosure, including the accident scenarios and controls used to prevent the accident scenarios, and because it is so unlikely that *the staff has reasonable assurance that a nuclear criticality will not occur.*

Milling

All calcined UO_2 powder is normally milled in an on-line hammer mill before being placed into 8-inch diameter polypaks. The UO_2 powder leaving the rear end of the calciner enters a chute and is conveyed either to a hammer mill (M-X10) or to an off-loading hood by two screw conveyers (discharge screws).

The first discharge screw (K-X09B) is set at an incline with the outlet end elevated. Powder is maintained in the discharge chute/first discharge screw inlet to provide a seal which separates the hydrogen-rich atmosphere of the calciner from the oxygen-rich environment to prevent a potential explosion. The powder seal is maintained by a level switch in the discharge chute and the incline of the screw. The level switch controls the activation and stopping of the first discharge screw with interlocks to ensure that the powder seal is maintained. Ex. 4

The first discharge screw deposits powder to the middle of the second discharge screw (K-X09D). K-X09D is a constant speed, reversible screw which can convey powder to either the hammer mill or an off-loading station. The only indication of the screw direction is by direct inspection. If power is lost to the second discharge screw drive motor, an interlock is activated which terminates power supply to the first discharge screw motor.

When operating in the direction of the mill, the second discharge screw deposits powder to a favorable geometry feed hopper located inside the nonfavorable geometry mill enclosure. A feed screw conveys the powder from the hopper to the mill. The mill consists of a rapidly rotating hammer blade motor within a housing having a grooved impact plate and screen. The combined action of the hammer, impact plate, and screen causes the agglomerated powder to be broken into finer particles. The milled powder falls into the mill discharge chute that channels powder into a polypak located inside the nonfavorable geometry airborne enclosure. A level probe located in the discharge chute senses the powder level in the polypak. A high level indication terminates power supply to the first discharge screw and the mill drive motor. When the mill drive motor loses power, an interlock stops the mill feed screw drive motor, which terminates power to the second discharge screw drive motor. This series of interlocks exists to prevent an accumulation of uranium oxide powder in a nonfavorable geometry enclosure due to the chute being filled with powder when the polypak is removed.

The mill is located inside a nonfavorable geometry airborne enclosure. The mill is water-cooled during operation. As a result, there is potential for accumulations of both uranium oxide powder and moderator inside the enclosure. Several features exist to prevent accidental criticality including

The staff has reviewed the nuclear criticality safety for the hood, including the accident scenarios and controls used to prevent the accident scenarios, and because it is so unlikely that *the staff has reasonable assurance that a nuclear criticality will not occur.*

Mill Product Hood

The mill product hood is an unfavorable geometry enclosure around the favorable geometry mill product polypak. The mill product hood is equipped with a funnel assembly that drains to a favorable geometry collection container that is enclosed in another airborne enclosure. The drain section has drillings to avoid accumulation of water in a nonfavorable geometry configuration.

Ex. 4

During normal operations, the mill product polypak fills with milled UO_2 powder. Newer designs have a tapered bottom that directs overflow powder into a geometry-controlled container. A level probe inside the discharge chute senses powder level in the polypak. If the polypak is full, a series of interlocks activate to stop the first and second discharge screws and the mill drive motor. These interlocks prevent

The staff has reviewed the nuclear criticality safety for the hood, including the accident scenarios and controls used to prevent the accident scenarios, and because it is so unlikely that

the staff has reasonable assurance that a nuclear criticality will not occur.

Calciner Product Hood

When product is not taken off through the mill, it is removed through the calciner product hood. This is a nonfavorable geometry airborne enclosure that surrounds the discharge end of a favorable geometry chute coming from the second discharge screw. The bottoms of the enclosure on Lines 1 and 5 are equipped with a funnel assembly that drains to a favorable geometry collection container. A polypak is placed at the bottom of the chute against a lip seal. The chute is equipped with an automated isolation valve. A level probe is located in the chute which senses when the polypak is full. A full pack indication terminates power supply to the second discharge screw motor which stops the first discharge screw motor. This interlock also closes the calciner product hood isolation valve. There is also a high-high level probe in the chute that is interlocked like the polypak fill probe, except that a key is required to reset the isolation valve. Although the hood may contain small amounts of powder from pack spillage, it is not expected to contain accumulations of either powder or moderator.

The staff has reviewed the nuclear criticality safety for the hood, including the accident scenarios and controls used to prevent the accident scenarios. and because it is so unlikely that

the staff has reasonable assurance that a nuclear criticality will not occur.

On the basis of the above analysis, the staff has reasonable assurance that a nuclear criticality will not occur in ADU Conversion Process.

UN BULK STORAGE

The UN for conversion is stored in one of six bulk storage tanks (each 7800 gallons) situated in a 2x3 array outside the manufacturing building. The tanks are inside a diked concrete containment pad which is divided between two pairs of tanks. Each pad section has its own sump, but the sumps share a common pump. Each tank has two recirculation pumps and dual in-line gamma monitors. These tanks rely on a series of administrative and active-engineered controls on [redacted] Ex. 4

[redacted]

The staff has reviewed the nuclear criticality safety for UN Bulk Storage and concludes that [redacted] *would be the most risk-significant event in these tanks. WELCO has determined that the controls used to ensure that* [redacted] *does not occur would make this a very unlikely event and, therefore, WELCO did not model the* [redacted] *scenario. Despite this determination, NRC staff performed calculations to model the effects of possible* [redacted] *in the UN tanks.* [redacted] *Therefore, the staff concludes that there is reasonable assurance that a nuclear criticality will not occur in UN Bulk Storage.*

URRS SAFE GEOMETRY DISSOLVER

During the conversion process from uranium hexafluoride into uranium dioxide powder, two broad categories of off-stream uranium-bearing solids are generated. These are "clean scrap" and "dirty scrap." The scrap solids are dissolved in one of three safe geometry dissolver systems installed adjacent to the Solvent Extraction area. Two of the dissolver systems are primarily for "clean scrap" and the third is for "dirty scrap."

The two "clean scrap" dissolvers feature a single contactor for each system. Clean scrap U_3O_8 dissolves with almost no residue forming UN solution clean enough for immediate use in ADU conversion. Solids, nitric acid, and water are metered into each contactor continuously while a slowly turning paddle agitator mixes the inputs. Solution produced at the dissolvers is collected in safe geometry intermediate storage vessels, analyzed for U-235 and free HNO_3 contents, and then pumped to UN bulk storage tanks. The maximum allowed U-235 concentration is [redacted] and the minimum allowed free HNO_3 is [redacted] before pumping it to bulk storage.

The "dirty scrap" dissolver features a set of three interconnected contactors. They are arranged to provide for uranium dissolution and also for separation of and water washing of insoluble residues, which are a substantial part of "dirty scrap" feed materials. Incinerator ash is the primary solid feed material. UN solution from the dissolver contains high levels of impurities and must be purified via solvent extraction before it can be returned to the ADU conversion process. The impure UN solution is pumped directly from intermediate safe geometry dissolver vessels to other safe geometry process vessels in the Solvent Extraction area. Residues are dried in ovens in the Fluoride Stripping area and either recycled through the dissolver for further uranium recovery or put into drums for burial disposal.

The Dissolver Input Hood achieves NCS control by [redacted] control. The Waste Residue Discharge Hood Overflow Chute achieves NCS control by [redacted] control. The Favorable Geometry Tanks, Favorable Geometry Vessels, Filter Presses and Cartridge Filters achieve NCS control by [redacted] control. Normal operating conditions show a k-eff of less than or equal to 0.95 and credible abnormal conditions show a k-eff of less than or equal to 0.98.

Ex. 4

The staff has reviewed the nuclear criticality safety for URRS Safe Geometry Dissolver, including the accident scenarios and controls used to prevent the accident scenarios, and agrees that the three risk-significant accident scenarios are non-credible because each scenario requires more than one unlikely circumstance to occur at the same time. The three scenarios are:

(1) [redacted]

(2)

(3)

Therefore, the staff concludes that there is reasonable assurance that a nuclear criticality will not occur in URRS Safe Geometry Dissolver.

<u>REVIEW OF OTHER 15 SYSTEMS</u>

NRC staff performed programmatic NCS reviews of the ISA or CSE License Annex for the other

15 systems. These License Annexes contained the required Process Summary and NCS Controls & Fault Trees, which included the accident scenarios and controls used to prevent the occurrence of the accident scenarios.

Based on the reviews, the staff concludes that the ISA or CSE License Annexes contain adequate NCS information to meet the requirements of Safety Condition S-2.

CRITICALITY SAFETY CONCLUSION

On the basis of its review of the ISA License Annexes for the four higher-risk systems (i.e., ADU Bulk Powder Blending, ADU Conversion Process, UN Bulk Storage, and URRS Safe Geometry Dissolver) and ISA or CSE License Annex for the other 15 systems, the NRC staff has reasonable assurance that WELCO has an adequate CSE development program and has adequate NCS evaluations onsite. WELCO is revising its CSEs in response to NRC inspection efforts and enforcement actions to ensure that they reflect actual conditions at the site.

ENVIRONMENTAL REVIEW

These changes are considered administrative in nature. The staff has determined that the proposed changes do not adversely affect public health and safety or the environment and are categorically excluded from the requirement to prepare a site-specific environmental assessment. Therefore, in accordance with 10 CFR 51.22(c)(11), neither an environmental assessment nor an environmental impact statement is warranted for this action.

CONCLUSION

Safety Condition S-2 requires WELCO to submit proprietary versions of Sections 1 and 5 of the four higher-risk systems. WELCO has met that requirement. Safety Condition S-2 requires WELCO to submit for NRC NCS review ISA License Annexes for the higher-risk systems and CSE License Annexes for the other systems according to a schedule. On the basis of the technical and programmatic reviews, WELCO has met that requirement for the following 19 systems:

System	Revision Number
ADU Bulk Powder Blending (done as ISA License Annex)	1
ADU Conversion (done as ISA License Annex)	1
ADU Fuel Rod Manufacturing	0
ADU Process Pelleting	1
Chemicals, Receipt, Handling, and Storage	0
Cylinder Washing	0
Final Assembly	1
Hoods and Containments	1

IFBA (Excluding Rods)	0
IFBA Fuel Rod Manufacturing	0 and 1
Laboratories	0
LLRW Processing	0
Plant Ventilation	4
Scrap Uranium Recovery Processing	0
Solvent Extraction	0
Storage of Uranium Bearing Materials	0
UN Bulk Storage (done as ISA License Annex)	1
URRS Safe Geometry Dissolver (done as ISA License Annex)	0
URRS Waste Treatment	0

Accordingly, Safety Condition S-2 has been revised to read as follows:

S-2 Criticality Safety Evaluations (CSEs) and Criticality Safety Analyses (CSAs) will define the interim criticality safety bases utilized throughout the CFFF. All CSEs/CSAs will be upgraded and/or completed in accordance with all applicable commitments in Chapter 6.0 of the License Application and all other regulatory requirements. Summaries of the CSEs/CSAs (in the format of License Annexes) will be submitted to NRC for review and approval. All completed CSEs/CSAs will be independently peer-reviewed in accordance with all applicable regulatory requirements and related procedures. Configuration control data packages for ongoing changes to facility structures, systems and components, and controls will be filed with their respective CSEs/CSAs to provide a substantially complete "living" framework for system Integrated Safety Assessments (ISAs) that will ultimately become the Final CFFF Design Safety Basis described in Chapter 4.0 of the License Application.

Based on the discussion, the staff concludes that the proposed changes will have no adverse affect on the public health and safety or the environment. Therefore, approval of the amendment is recommended.

The Region II inspection staff has no objection to this proposed action.

PRINCIPAL CONTRIBUTOR
Harry D. Felsher

NRC FORM 374

U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE

CORRECTED COPY

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 36, 39, 40, and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1. Westinghouse Electric Company LLC (WELCO)	3. License Number SNM-1107, Amendment 22
2. P.O. Box 355 Pittsburgh, Pennsylvania 15230-0355	4. Expiration Date November 30, 2005
	5. Docket No. 70-1151 Reference No.

6. Byproduct Source, and/or Special Nuclear Material	7. Chemical and/or Physical Form	8. Maximum amount that Licensee May Possess at Any One Time Under This License
A. U-235	A. Any	A.
B. U-235	B. Any, except metal, enriched to not more than 5.0 w/o	B.
C. U-233	C. Any	C.
D. Pu-238, Pu-239	D. Sealed sources	D.
E. Plutonium	E. Feedstock with transuranics and fission products	E.

Ex. 2

9. Authorized place of use: The licensee's existing facilities at Columbia, South Carolina.

MATERIALS LICENSE SUPPLEMENTARY SHEET	License Number SNM-1107
	Docket or Reference Number 70-1151
	Amendment No. 22 **CORRECTED COPY**

10. This license shall be deemed to contain two sections: Safety Conditions and Safeguards Conditions. These sections are part of the license and the licensee is subject to compliance with all listed conditions in each section.

11. Deleted by Amendment 20, dated November 1999.

FOR THE NUCLEAR REGULATORY COMMISSION

Date: ________

By: Eric J. Leeds, Acting Chief
Division of Fuel Cycle Safety
and Safeguards
Washington, DC 20555

License Number
SNM-1107

MATERIALS LICENSE
SUPPLEMENTARY SHEET

Docket or Reference Number
70-1151

Amendment No. 22
CORRECTED COPY

SAFETY CONDITIONS

S-1. Authorized use: For use in accordance with statements, representations, and conditions in the license application dated April 30, 1995, and supplements dated August 4 and 25, September 25, 1995; November 8, August 30, 1996; July 14 and 25, November 17, 1997; name change amendment December 22, 1997; April 3, June 30, July 13 and 23, October 21 and 30, 1998; February 12, 1999; name change amendment September 28, 1998; January 18, and February 22, 1999.

S-2 Criticality Safety Evaluations (CSEs) and Criticality Safety Analyses (CSAs) will define the interim criticality safety bases utilized throughout the CFFF. All CSEs/CSAs will be upgraded and/or completed in accordance with all applicable commitments in Chapter 6.0 of the License Application and all other regulatory requirements. Summaries of the CSEs/CSAs (in the format of License Annexes) will be submitted to NRC for review and approval. All completed CSEs/CSAs will be independently peer-reviewed in accordance with all applicable regulatory requirements and related procedures. Configuration control data packages for ongoing changes to facility structures, systems and components, and controls will be filed with their respective CSEs/CSAs to provide a substantially complete "living" framework for system Integrated Safety Assessments (ISAs) that will ultimately become the Final CFFF Design Safety Basis described in Chapter 4.0 of the License Application.

S-3. The licensee shall maintain and execute the response measures in the Site Emergency Plan, dated April 30, 1990, and revisions dated March 31, and September 30, 1992; March 25, August 15, and September 30, 1994; January 9, February 17, August 17, and October 23, 1995; or as further revised by the licensee consistent with 10 CFR 70.32(i).

S-4. Deleted by Amendment 12, April 1998.

MATERIALS LICENSE SUPPLEMENTARY SHEET	License Number SNM-1107
	Docket or Reference Number 70-1151
	Amendment No. 22 **CORRECTED COPY**

SAFEGUARDS CONDITIONS

SECTION 1.0 -- MATERIAL CONTROL AND ACCOUNTING

SG-1.1 The licensee shall follow pages i through xviii and Chapters 1.0 through 9.0 of its "Fundamental Nuclear Material Control Plan for the Columbia Fuel Fabrication Facility," which has been partially revised as indicated by Revision 30 (dated September 20, 1999). Any further revision to this Plan shall be made only in accordance with, and pursuant to, either 10 CFR 70.32(c) or 70.34.

SG-1.2 Operations involving special nuclear material which are not referenced in the Plan identified in Condition SG-1.1 shall not be initiated until an appropriate safeguards plan has been approved by the Nuclear Regulatory Commission.

SG-1.3 In lieu of the requirements contained in 10 CFR 74.13(a)(1) and (a)(2) to use the Forms DOE/NRC-742 and 742C, the licensee may use computer generated forms provided all information required by the latest printed instructions for completing the particular form is included.

SG-1.4 In lieu of the requirements contained in CFR 70.54 and 74.15 to use the DOE/NRC Form-741, the licensee may use computer generated forms provided all information required by the latest printed instructions for completing the particular form is included.

SG-1.5 Deleted Per Amendment 3, August 1996 Commitment now contained in licensee's Fundamental Nuclear Material Control Plan.

SG-1.6 Notwithstanding the requirements of the FNMC Plan identified in License Condition SG-1.1, the licensee may use (1) a single standard for measurement control (including daily control limit monitoring and bias corrections) for any linear-response tube or rod scales, in any initially demonstrated to be linear over its range of use within the discrimination of the scale by calculating a bias at four levels across the range of use and demonstrating that the four results are not statistically different, and (2) that the continued linearity of response of the scales is verified by monthly calibration against at least four traceable standards covering the range of use.

SG-1.7 Notwithstanding the requirements contained in Sections 5.2.2 and 5.2.3 of the licensee's Fundamental Nuclear Material Control Plan, the licensee is exempted from physical inventory requirements relative to the material identified in Condition S-4; provided the conditions and commitments contained in the licensee's November 30, 1993, letter (identification # NRC-93-036) are satisfied.

SG-1.8 Notwithstanding the requirement of Section 6.2.1(a).5 of the licensee's Fundamental Nuclear Material Control Plan to unpackage and perform an item count upon receipt of special nuclear material, the licensee is exempted from such requirement relative to the material identified in Condition S-4; provided the conditions and commitments contained in the licensee's November 30, 1993, letter (identification # NRC-93-036) are satisfied.

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SG-1.9 Notwithstanding the requirement of Section II.A.7, block U, of NUREG/BR-0006, which is incorporated via 10 CFR 74.15, to complete receiver's measurements of scrap receipts (following recovery processing) within 60 days of receipt, the licensee shall not be subject to any time limit relative to recovering and measuring received UF_6 heels when the block U action code (of DOE/NRC Form 741) is used to book such receipts.

SG-1.10 With respect to Section 5.1.4 (b) of the Plan identified by Condition SG-1.1, *"allowed number"* within the phrase *"allowed number of defects"* is hereby specified as being:

(i) up to two defects when each item within a batch of items has an assigned value equal to or less than 50 grams U-235;

(ii) no more than one defect when each item within a batch of items has an assigned value of less than 500 grams U-235, but one or more items has an assigned value in excess of 50 grams U-235; and

(iii) zero defect when any item within a batch of items contains 500 or more grams U-235.

SG-1.11 Notwithstanding the first paragraph of Section 7.1 of the Plan identified by Condition SG-1.1, the licensee shall conduct shipper-receiver comparisons on all SNM materials received (regardless of whether booked on the basis of receiver's or shipper's values), except for those materials identified in Section 7.1 of NUREG-1065 (Rev. 2) as being exempted from shipper-receiver comparisons.

SECTION 2.0 -- PHYSICAL PROTECTION OF SNM OF LOW STRATEGIC SIGNIFICANCE

SG-2.1 The licensee shall follow the physical protection plan entitled, "Physical Security Plan," Revision 27 dated September 1, 1999 (letter dated September 1, 1999); and as it may be further revised in accordance with the provisions of 10 CFR 73.32(e).

SECTION 3.0 -- INTERNATIONAL SAFEGUARDS

SG-3.1 The licensee shall follow Codes 1 through 6 of Transitional Facility Attachment No. 5A dated August 31, 1988, to the US/IAEA Safeguards Agreement. Such Transitional Facility Attachment shall be interpreted in accordance with Conditions SG-3.1.1 through SG-3.1.7.

SG-3.1.1 With respect to Transitional Facility Attachment Code 2:

The reference design information is that dated by the licensee on October 14, 1985. "Information on the Facility" also includes other facility information submitted via Concise Notes in accordance with 10 CFR 75.11(c).

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SG-3.1.2 With respect to Transitional Facility Attachment Code 2.2:

Substantive changes to the information provided in the Columbia Plant Design Information Questionnaire (DIQ) means those changes requiring amendment of the Transitional Facility Attachment. Such changes shall be provided by letter to the NRC Office of Nuclear Material Safety and Safeguards at least 70-days in advance of implementation.

Non-substantive changes to the information in the DIQ means those changes not requiring amendment of the Transitional Facility Attachment. Such changes shall be provided by Concise Note (From DOE/NRC-740M) within 30 days of receiving notification from the NRC that the facility has been identified under Article 39(b) of the US/IAEA Safeguards Agreement.

The types of modifications with respect to which information is required under 10 CFR 75.11, (to be submitted in advance), are those items stated in Code 2.2, specifically:

(a) "Any change in the purpose of type of facility" means:

Any deviation from the described activities involving special nuclear material and any change to the maximum enrichment and/or quantities of U-235 currently authorized by License No. SNM-1107, and/or as described in Paragraph 5 of the Design Information Questionnaire (DIQ) dated October 14, 1985, or as modified in accordance with 10 CFR 75.11(c). Included also is any deviation from the described special nuclear material (SNM) production activities described in paragraph 6 of the DIQ dated October 14, 1985, or as modified in accordance with 10 CFR 75.11(c).

(b) "Any changes in the layout of the facility which affects safeguards implementation of the provisions of the Protocol" means:

Any change in the existing facility and/or site layout or new addition affecting any activity involving SNM as described in Paragraphs 10 and 11 (per the referenced attachments of the DIQ dated October 14, 1985, or as modified in accordance with 10 CFR 75.11(c). Included also is any modification to, or deviation from, the data provided in Paragraphs 13 and 14 (per the referenced attachments) of the DIQ dated October 14, 1985, or as modified in accordance with 10 CFR 75.11(c).

(c) "Any change that makes the selected Key Measurement Points (KMPs) (as described in Code 3.1.2) inadequate for the Agency's accounting purpose" means:

Any change to the KMPs as described in Code 3.1.2 of the Westinghouse-Columbia Transitional Facility Attachment to the US/IAEA Safeguards Agreement, or as modified in accordance with 10 CFR 75.11(c), that results in any KMP alteration affecting the purpose of KMPs as stipulated by 10 CFR 75.4(m).

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(d) "Any change in the physical inventory procedures that would adversely affect the inventory taking for the Agency's accounting purposes" means:

Any change to the description data contained in Paragraph 34 (per the referenced attachments) of the DIQ dated October 14, 1985, or as modified in accordance with 10 CFR 75.11(c), that would not permit the Agency to conclude an SNM material balance for the Westinghouse-Columbia facility.

(e) "Introduction of a significantly less accurate analytical method for accounting purposes" means:

Any recalculation of the "Relative Errors-Random and Systematic" as listed in Attachment 36.2 referenced in Paragraph 36 of the DIQ dated October 14, 1985, or as modified in accordance with 10 CFR 75.11(c), that results in the estimates of the random and systematic errors being affected by a factor of two or more.

(f) "Decrease in the frequency of calibrating measuring equipment if it significantly decreases the accuracy of the materials accounting system" means:

Any change that results in the estimates of the systematic error being affected by a factor of two or more.

(g) "Any change in the statistical procedures used to combine individual measurement error estimates to obtain limits of error for shipper/receiver (S/R) differences and material unaccounted for (MUF)" means:

Any deviation from (or modification of) the equations and/or calculations outlined in Attachments 37.1, 37.2, and 37.3 referenced in Paragraph 37 of the DIQ dated October 14, 1985, or as modified in accordance with 10 CFR 75.11(c).

SG-3.1.3 With respect to Transitional Facility Attachment Code 3.1.2:

KMP* -- This is a KMP in which all shipper receiver differences (SRDs) must be recorded and reported even if numerically zero. SRDs are computed and reported by the Nuclear Materials Management and Safeguards System upon receipt of the receiver's measurement results.

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SG-3.1.4 With respect to Transitional Facility Attachment Code 4:

The licensee shall use the material composition codes documented in the DIQ dated October 14, 1985, and as modified by Concise Notes. Further, notwithstanding any other requirements for advance notification and/or reporting, the licensee may add or delete composition codes for nuclear material routinely processed and on inventory at CFFF immediately upon telephone notification to the Office of Nuclear Material Safety and Safeguards. Follow-up documentation, in the form of a Concise Note accompanied by appropriate changes to Table 1 of Attachment 34.8 to the DIQ shall be submitted within three regular workdays of the telephone notification.

SG-3.1.5 With respect to Transitional Facility Attachment Code 4.1:

Measured discards should be reported as an SN (Shipment to non-safeguards facility) when shipped off-site to an authorized burial ground. (The IAEA system will not process measured discards as loss/disposal (LDs) when they are shipped off-site).

SG-3.1.6 With respect to Transitional Facility Attachment Code 5.1.1:

For inventory changes, time of recording, "upon" means: No later than the next regular workday (Monday through Friday).

For those occasions where natural or depleted uranium is inadvertently enriched above 0.711 percent through commingling with residual enriched uranium in process equipment, the resultant product shall be considered as being produced through a blending operation and the material category change shall be recorded upon obtaining measurement confirmation that a material category change has occurred.

SG-3.1.7 With respect to Transitional Facility Attachment Code 6.2.2:

For Concise Notes describing the anticipated operational programme, "anticipated operational programme" means: Anticipated physical inventory schedule.