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U.S. NUC. REG. COMM. NMSS MAIL SECTION

April 3, 1979

WRD-LS&S-703

U. S. Nuclear Regulatory Commission
Office of Nuclear Material Safety & Safeguards
Division of Fuel Cycle & Material Safety
Washington, D. C. 20555

DOCKETED USNRC APR 0 5 1979 NMSS MAIL SECTION DOCKET CLERK

Attention: Mr. L. C. Rouse, Chief
Fuel Processing & Fabrication Branch

Reference: WRD-LS&S-683, dated March 7, 1979

Gentlemen:

Subject: Retransmittal of Application for Amendment to Expand Facility, License SNM-1107, Docket 70-1151

The Westinghouse Electric Corporation hereby requests an amendment to License SNM-1107 to authorize operations with special nuclear material in the expansion to our Columbia Facility, in accordance with the attached application.

The material transmitted by the reference is to be discarded in its entirety and replaced with the attached material.

The proprietary portion of this application is being transmitted under separate correspondence in accordance with the provisions of 10 CFR 2.790.

Please find enclosed a check payable to the U. S. Nuclear Regulatory Commission in the amount of $34,600 in accordance with 10CFR170.31.

If you have any questions regarding this matter, please write to me at the above address or telephone me on 412-373-4652.

Very truly yours,

Ronald P. DiPiazza

Ronald P. DiPiazza, Manager
NES License Administration

THIS DOCUMENT CONTAINS POOR QUALITY PAGES

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COLUMBIA PLANT EXPANSION

This expansion consists of the construction of an approximately 100,000 square feet addition to the present manufacturing building. 75,000 square feet of the new area is allocated for factory space, 5,000 square feet for truck docks and 20,000 square feet for mezzanines. This addition is adequate to house new product improvement equipment, a chemical process facility, equipment to increase production and increased in-process inventory. Also included for use in this area are a second incineration system for recovery of uranium from waste materials and a system for uranium recovery from scrap by solvent extraction.

The building expansion will be effected by the extension of the present manufacturing space in the north and west directions, Figure 1.3.2.1. The exterior walls will be prefabricated, prestressed concrete, tee panels which are consistent with the stringent specifications of the present building.

Approximately 75,000 of the 100,000 square feet space will be used for new or expanded chemical and mechanical areas. The remaining space will be utilized for in-plant offices and service areas.

Three basic new items will be operated in the expanded chemical manufacturing area. Each is listed below with a brief description of the operation and/or equipment.

(1) Solvent Extraction

The solvent extraction equipment includes a dissolver system similar to the units now used in the present scrap recovery operation, preparatory equipment, feed and adjustment tanks, and extraction column and a stripping column, storage and blending tanks, sludge concentration and collection systems and necessary piping, ventilation, instrumentation, and operation platform.

(2) Chemical Process Development Facility

The basic equipment for the development lab will provide an environment for

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experimental work. A walk-in ventilated hood, small fume hood and dust collectors will be used for dust and fume control. A tube calciner and sintering furnace units will be used to simulate the present production units for development purposes. Material handling, scales, etc. are examples of support equipment to be utilized in the lab. Special equipment for specific development projects will be provided as needed.

(3) Incinerator System

The second incinerator system will be installed in the new building addition. The system will consist of an incinerator, quench tower, absorber tower, heat exchanger, sump tank, condenser, reheater, oil tank, filter house and motor control center.

The expansion area will be covered by the plant criticality alarm system and all personnel working in this area will be covered by the licensee's bioassay program as described in Section 3.2.3 of the present license.

ATTACHMENT 2

PLANT EXPANSION VS W ENVIRONMENTAL EVALUATION, MARCH 1975

The proposed operations in the plant expansion have been compared with the March 1975 W Environmental Evaluation. In general, all parameters are within the limits based upon a throughput of 1600 metric tons of uranium per year as discussed in the report. The following table lists the Environmental Evaluation commitments and the corresponding plant expansion parameter:

ENVIRONMENTAL EVALUATION COMMITMENT	PLANT EXPANSION PARAMETER
1. The developed area occupies less than 5% of the total site area of 1158 acres (i.e. 1158 x .05 = 57.9 acres)	1. The plant expansion consists of an area of approx. 100,000 ft^2. The total disturbed area (including the existing building, plant expansion, lagoons, waste treatment, parking lot, etc.) is less than 50 acres.
2. A 50,000 ft^2 building is described to accomodate fabrication of machined components plus a 50,000 ft^2 expansion of the contamination controlled area.	2. The total area of the plant expansion is of approx. 100,000 ft^2 and will accomodate additional operations to increase capacity.
3. The plant additions will increase production to 1600 MTU/year.	3. The capacity is expected to be less than 1200 MTU/year.
4. The building is of modern design, architecturally expressed by its long simple lines of rectangular interconnecting areas, and designed to complement its rural flat surroundings.	4. The plant expansion is architecturally similar to the existing building.
5. The total gaseous discharge rate to the environment is less than 160,000 ft^3/min.	5. The total expected gaseous discharge rate will be less than 160,000 ft^3/min.
6. Gaseous effluent discharge rates were estimated at 26.94 alpha uCi/week (400 MTU/yr.) and 71.94 alpha uCi/week (1600 MTU/yr.	6. The average weekly gaseous effluent discharge rate for 1978 was less than 50 alpha uCi/week. This is well within the environmental estimate. The plant expansion contribution is expected to be minimal.
7. Gaseous effluent exhaust stacks are described.	7. All effluents will be discharged throug existing stacks except for the new incinerator which will exhaust through a separate stack. Activity effluents fro the incinerator are expected to be less than the present incinerator.

ENVIRONMENTAL EVALUATION COMMITMENT	PLANT EXPANSION PARAMETER
8. Exhaust effluents will be maintained below MPC.	8. Average stack effluents for 1978 were well within MPC. Exhaust concentrations for the plant expansion ventilation will also be well below MPC.
9. Liquid waste stream concentrations must be less than 3×10^{-5} alpha uCi/ml before leaving the plant.	9. Additional liquid wastes will include solvent extraction tank system scrubber water and incinerator scrubber water. No significant increases over present operations are expected. All liquid effluents will be directed into existing piping.
10. Solid wastes are either treated to recover uranium or buried at an NRC licensed burial ground. Approximately 40-60 bales/day of combustible waste and 4 bales/day of non-combustible contaminated waste will be generated.	10. Burial disposal of combustible waste will be reduced with the additional incinerator capacity. The total quantity of non-combustible contaminated waste is expected to decrease because of increased scrap recovery capabilities.
11. Exposure pathways include uranium release via air and water.	11. No new pathways are expected.
12. Population dose commitments are calculated for transportation of uranium bearing materials, including scrap and waste.	12. Both scrap and waste shipments should be reduced when the plant expansion becomes operable.

ATTACHMENT 3

LIQUID WASTE DISPOSAL PROPOSAL

The following plan describes a proposed method for recovering uranium contained in a CaF_2 matrix in on-site waste lagoons. The concept includes removal of sludge from the lagoons, transfer to a mixing tank to solubilize the uranium, "naturalize" the material by addition of depleted uranium and appropriately sample the material to verify that a natural uranium equivalency has been achieved.

This material will then be used as feed to an operation which extracts uranium from natural phosphate deposits. This operation will recover essentially all of the uranium and fluorides as salable products and dispose of the calcium as gypsum ($CaSo_4$).

Liquid waste treatment operations at Columbia have generated approximately 2.5 million gallons of sludge containing uranium in a CaF_2 matrix. Table I presents the physical and chemical properties of the CaF_2. This material will be transferred from the lagoons to a tank where it will be heated and mixed with sulfuric acid and diatomatious earth to solubilize the uranium.

Depleted uranium in an aqueous form will be added to the slurry in sufficient quantities to "naturalize" it to a maximum 0.71% U-235 enrichment, adjusted downward to account for the sampling error.

Once the naturalization step has been confirmed, the natural mixture will be transferred to storage tanks. From these tanks, it will be transferred to tank trucks (nominal 4000 gallon capacity) and shipped to Lakeland, Florida where the material will be introduced into the uranium recovery operation at a rate of approximately 4000 gallons per day. At this point, the material will become an integral part of the uranium recovery unit process.

Key elements of the operation include:

- assuring a homogenous slurry in the lagoons
- radiological controls and surveillance during lagoon and tank transfers to minimize contamination

- sampling and analyses of the naturalized slurry to assure uniform concentration and thus uniform enrichment
- control of each shipment batch to a maximum U-235 quantity
- minimize separation of solids from liquids
- verify naturalization of the mixture
- selection of a transportation mode to safely transport the material

Environmentally, the proposal is very attractive when compared with the alternative of disposal of the sludge in an NRC licensed burial ground. First, the bulk of the uranium will be recovered for reuse in the light water fuel cycle. Second, the fluorides will be recovered as fluorosisilic acid. The only waste product will be gypsum which is a normal waste from the phosphate mining operations.

Approximately 1,000 tank truck shipments are required to remove the existing inventory. If the program is successful, routine shipments will be made to process the 550,000 gallons per year of sludge which is generated annually. Based upon measured external radiation levels from the sludge, the population dose commitment is expected to be minimal.

A test program is planned to determine whether the uranium in the sludge can be converted to the soluble form and whether this material is chemically consistent with the phosphate plant's system.

The following licensing actions are requested:

1. Westinghouse is currently licensed to perform waste processing, including acid treatment and dissolution, within existing facilities. We intend to perform the sludge preparation in specially designed equipment located near the waste lagoons. Details of this installation will be supplied at a later date.

2. Approval is requested for the downgrading of the existing sludge from the present enrichment (approximately 2.71%) to natural. Minimum criteria for the downgrading is requested, including a definition of natural uranium and maximum acceptable sampling error. A detailed sampling plan will be supplied at a later date.

3. Approval is requested to remove this material from NRC jurisdiction and transfer to the State of South Carolina jurisdiction. Subsequent approvals for material transfers, transport and recovery will then be pursued at the appropriate state levels.

PHYSICAL AND CHEMICAL PROPERTIES OF CaF_2

1. 2.5×10^6 gallons by end of 1978
2. 3.05×10^6 gallons by end of 1979
3. 550,000 gallons per year (1500 gallons/day at 800 MTU/yr.)
4. Properties

	High	Low
ph	12.5	10.1
% Solids	38.6	35.5
% Water	61.4	64.5
U, ppm	286	152
U Enrich, %	2.71	
Soluble F, ppm	33	27

5. Major Impurities (Wt. %)

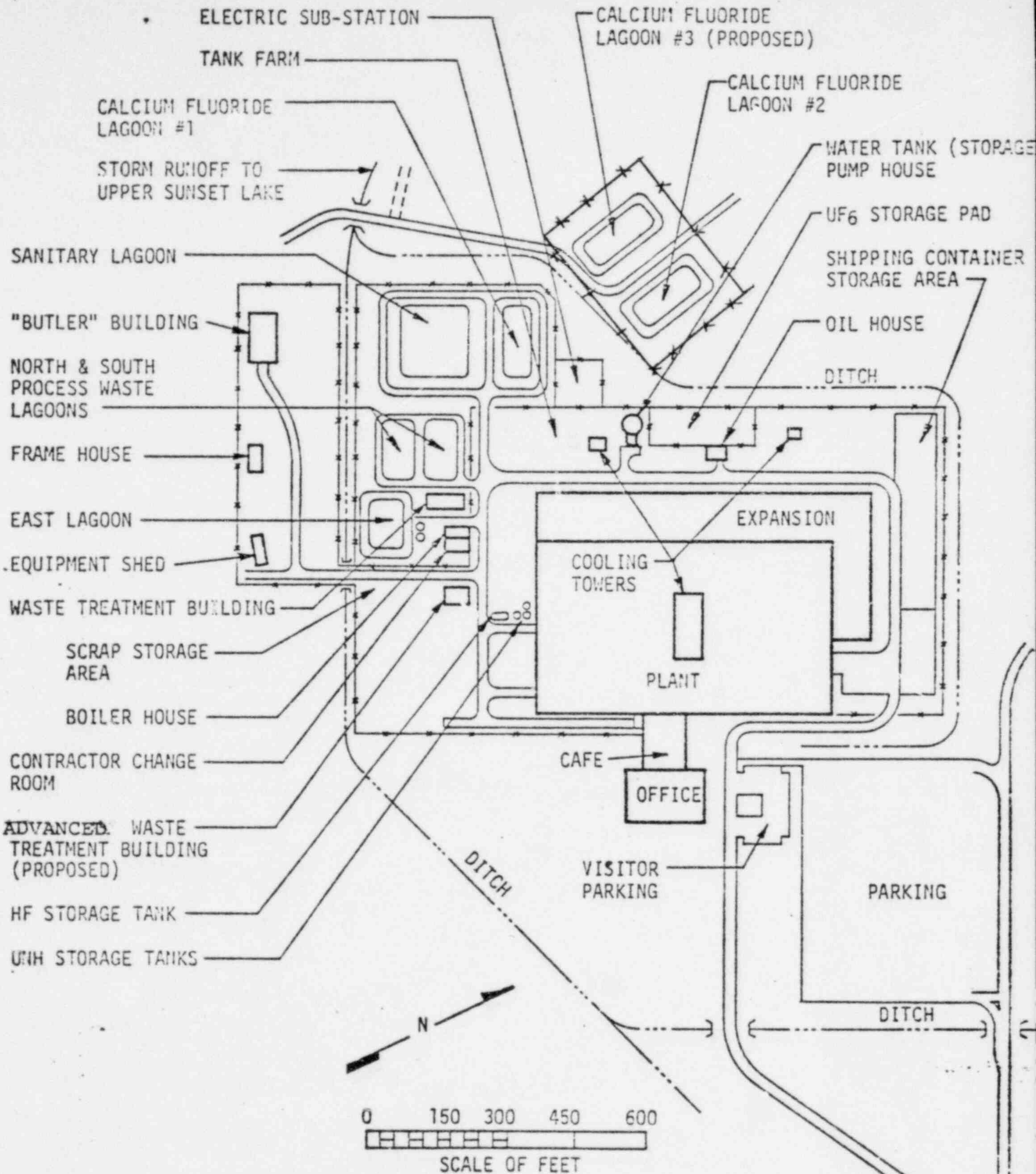
Al	0.7	0.3
Si	2.0	0.6
Fe	0.3	0.3
Mg	1.0	1.0
Ti	0.03	0.03
Ni	0.02	0.01
Mn	0.01	0.01
Cu	0.003	0.001

REVISION RECORD

Revision No.	Date of Revision	Pages Revised	Revision Reason
4	12-30-77	223, 224, 225	Revised criteria to agree with 0.3 fraction critical.
4	12-30-77	226	Data deleted.
4	12-30-77	230.1	Page added.
4	12-30-77	233	0.3 fraction critical was 0.4.
4	12-30-77	234	Clarified requirements for independent review of data.
4	12-30-77	254	Clarified retention of records of component approvals.
5	2-6-78	208	Revised to read "open face and laboratory-type hoods."
5	2-6-78	208.1, 209	Deleted airborne concentration option.
5	2-6-78	228	Revised to qualify concrete reflection and calculation assumptions.
6	3-3-78	22	Expanded description of systems provided with emergency power.
6	3-3-78	24	Specified that waste processing is conducted in the Contamination Controlled Area.
6	3-3-78	100	Specified that liquid waste evaluation is conducted in the Contamination Controlled Area.
6	3-3-78	210	Inserted word "automatically."
7	3-28-78	204	^{235}U increased to 50,000 kilograms
7	3-28-78	263.1	Revised to update bioassay frequency data.
7	3-28-78	263.2	Revised In-vivo action levels.
7	3-28-78	263.3	New table on urinalysis action levels.
7	3-28-78	263.4, 263.5	Pages renumbered
8	3-5-79	18	Revised Figure 1.3.2.1
8	3-5-79	20	Revised to include side entrance to facility
8	3-5-79	21	Revised to include side entrance to facility

REVISION RECORD

Revision No.	Date of Revision	Pages Revised	Revision Reason
8	3-5-79	76	Revised to include solvent extraction to scrap treatment and to delete the last sentence of the third paragraph.
8	3-5-79	77	Revised Figure 1.9.0.1 to reflect plant expansion.
8	3-5-79	122-122b	Delete "1.9.4 Reserved" from middle of page. Add Figure 1.9.4.1 and Table 1.9.4.1
8	3-5-79	151	Revised to include solvent extraction to scrap treatment and to delete the last sentence of the third paragraph.
8	3-5-79	153	Delete "Proprietary Information" at top of page.
8	3-5-79	158	Delete the words "the material" on third and fourth lines and replace with "and purify the materials if needed."
8	3-5-79	160	Add the words "or UO_2" to "U_3O_8" between the blocks labeled "Thermal Processing" and Packaging and Storage."
8	3-5-79	164	Modify section 1.9.4.5 to read "Various solid materials which are uncontaminated may be introduced into a thermal processing step directly to convert them into desired uranium oxide form."
8	3-5-79	194	Delete section 1.10 entitled "Off-Site Release Evaluation."
8	3-5-79	194a-k	Add new section entitled "Auxiliary Incineration System."
8	3-5-79	194l-q	Incorporate new section entitled "Chemical-Manufacturing Development Laboratory."
8	3-5-79	194r-ae	Incorporate new section entitled "Purification of Contaminated Scrap Through Solvent Extraction."
8	3-5-79	194af	Reprint section 1.10 entitled "Off-Site Release Evaluations" previously printed on page 194.
8	3-5-79	206	Modify the first sentence in subparagraph 2.2.1 to read "Four emergency stanby generators with rated capacity of 250 kw, 300 kw, and 2 at 500 kw will be maintained.



COLUMBIA SITE BUILDING LOCATIONS

FIGURE 1.3.2.1

1.3.4 (continued)

Access to the facility during normal working shifts is granted to:

(1) Certain NFD employes and certain other Westinghouse employes assigned to the Columbia Site, through the front main entrance upon or second side entrance upon display of their identification badges to the security force on duty. 8

(2) Other NFD employes to the NFD offices directly, upon display of their identification badges to the security force on duty at the front entrance or second side entrance of the facility. 8

(3) Other Westinghouse employes assigned to the Columbia Site through the front entrance to the facility. Such visitors must sign a visitor's register and be issued a visitor's badge by the person on duty.

(4) Other visitors by registering at the appropriate NFD reception desk. All visitors must be issued a visitor's badge and all non-Westinghouse visitors are escorted.

(5) Vehicles (as far as the shipping-receiving docks) through electrically-operated gates controlled by the security force.

1.3.4 (continued)

During off-shifts, the entrances are locked and the facility is regularly patrolled at intervals not exceeding four hours by a member of the site security force. All access during these shifts is through the front entrance or second side entrance to the facility and is controlled by a member of the site security force who is stationed there at all such times. 8

A security service report is initiated on a shift basis by the security guard and is kept on file by the Manager, Security and Services.

Keys for the locked doors controlling access to the Columbia facility are issued to the NFD Manufacturing/ Columbia Plant Manager and to the Manager, Security and Services. The site security force is issued keys for locked doors controlling access to the NFD Manufacturing building. The Facilities Engineering Manager and the Maintenance Supervisors are issued keys to the factory area of the facility. *

Additional security measures as specified in Amendment SG-4, as amended, are implemented when mixed oxide fuel is possessed on-site.

1.3.5 Utilities and Services

The Columbia Site is served by a single electrical supply line. Four diesel-powered standby generators are installed to meet the emergency electrical power requirements of the site in the event of a temporary 8

1.9 Processing Operations

The processing operations to be performed on radioactive materials under this license may be divided into a number of distinct categories. The first category is the ADU conversion operations * which employ chemical means to convert UF_6 to uranium oxide * powder. The second category, then, is the fabrication operations which use essentially mechanical processes to produce fuel assemblies containing encapsulated UO_2 pellets.

Another category is the analytical operations which use a variety of spectrographic and wet chemical operations on small samples of material to assure that material specifications are met.

Still another category is the treatment of scrap generated on site to permit it to be recycled into production operations or more closely controlled prior to discarding. This treatment includes chemical dissolution and precipitation, solvent extraction and dry processes. | 8

Westinghouse also has developed and is currently operating an alter- * nate process for converting UF_6 to uranium oxide. This is the Direct* Conversion Fluidized Bed (DCFB) process which may contribute to * reduced chemical effluent levels.

1.9.1.2 UF_6 to UO_2 Conversion

The chemical operations required to convert UF_6 to uranium oxide are carried out in a continuous processing line which is a closed system. Engineered safeguards are applied to particular operations as required to prevent, or to detect and control, abnormal conditions. *

Low enriched uranium in a closed system requires only routine radiation protection precautions. The engineered safeguards specified above will effectively minimize the possibility of a significant material release.

Individual items of processing equipment are designed within the MPV for diameter, slab thickness, mass or volume. For subcrits that are, or could credibly become moderated, the equipment spacing is established using surface density or solid angle criteria. The system would remain subcritical for the maximum ^{235}U enrichment authorized for Model 30A or 30B cylinders. *

1.9.1.3 Storage of UO_2 Powder

The dry uranium oxide powder is stored in a closed system until it is released by Quality Control for use in the fabricating areas or for shipment in licensed packages to other facilities. *

Low enriched uranium in a closed system or sealed packages requires only routine radiation protection

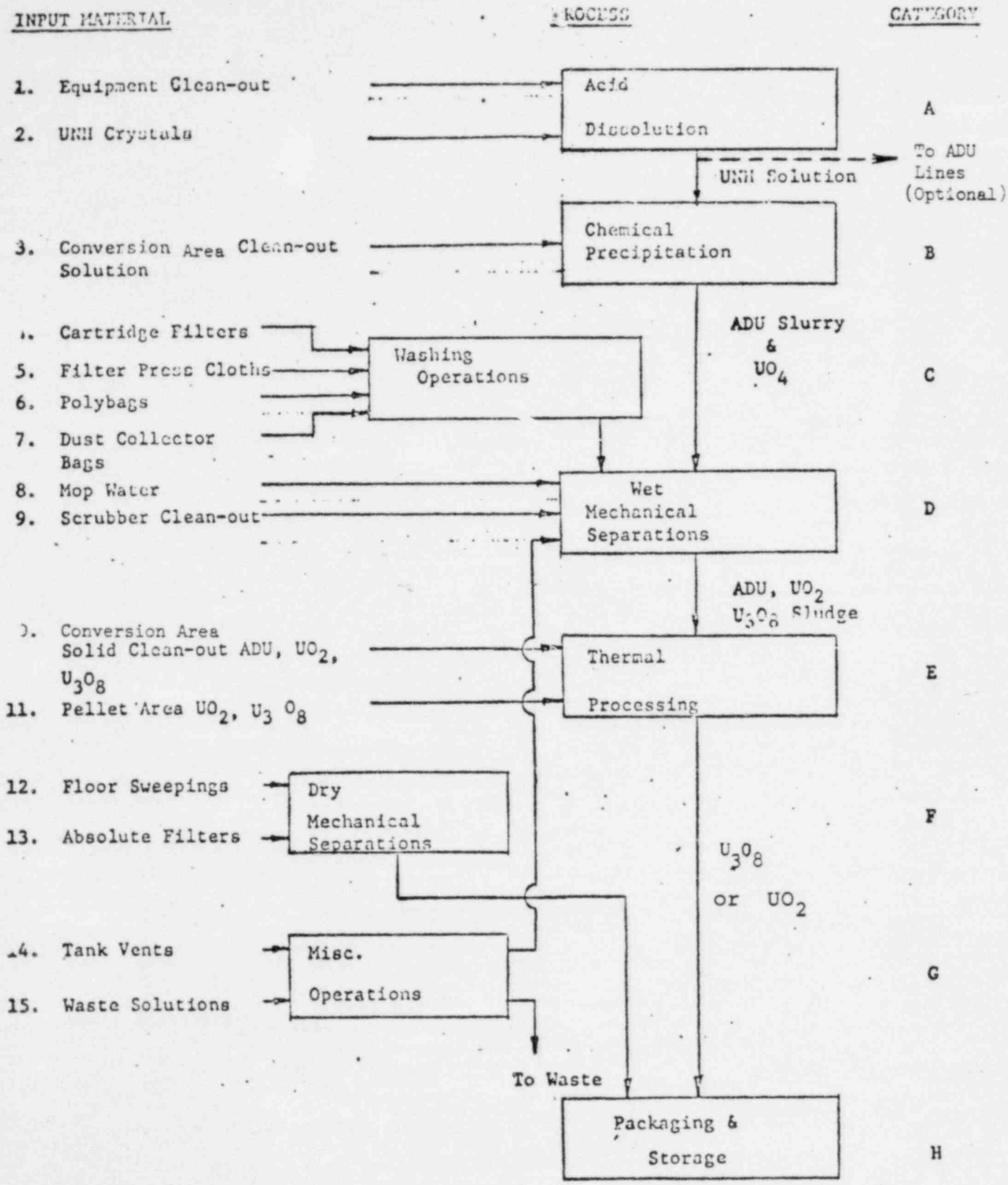
1.9.4 Scrap Recovery Operations

1.9.4.1 General

Scrap recovery process operations are characterized as batch operations involving a variety of input forms. The preliminary operations concentrate and purify the materials if needed and convert it to forms readily processed into U_3O_8 powder. Not all materials require processing through the entire sequence of operations. 8

The basic processing sequence includes dissolution of solid forms, conversion to slurry form by precipitating ADU from the solution, dewatering the slurry form by wet mechanical separation, calcining the resulting sludge in furnaces, and packaging and storing the resulting product. The product is sampled and analyzed before release to manufacturing.

Various other inputs are fed into the basic sequence at appropriate points. Liquids containing disolved uranium are introduced into the solution hold tanks used to supply the precipitator columns. Clean aqueous suspensions from mopping or off-gas scrubbing operations and from laundering cloth filters, poly bags, etc. are introduced prior to the wet mechanical separation operation. Clean powder scrap, scrapped pellets and other quality solids may be subjected to a dry mechanical separation step and then are introduced, along with the wet sludge, to the calcining operation. Thermal processing capabilities also exist to convert this clean scrap material directly into usable UO_2 powder. 8



SCRAP RECOVERY PROCESS OPERATIONS FLOW SHEET

Figure 1.9.4.1

1.9.4.5 (continued)

Various solid materials which are uncontaminated may be introduced into a thermal processing step directly to convert them into the desired uranium oxide form. 8

1.9.4.6 Dry Mechanical Separation (Category F)

Non-homogeneous uranium oxides are crushed to a powder in a mechanical, granulator prior to the * dissolution operation to promote the speed of the reaction. Contaminated UO_2 and U_3O_8 such as that found in floor sweepings is screened in a vibratory separator to remove trash and gross impurities. In addition, accumulations of chemically uncontaminated UO_2 or U_3O_8 such as those occurring on absolute filters in the Controlled Area are removed for further processing by manual techniques such as shaking, scraping, etc.

Dry materials charging, dry mechanical separation, pellet and powder granulation, and final packaging are performed in hoods, hopper dryboxes, or similar enclosures equipped with individual blowers and HEPA filters to minimize airborne contamination levels. The filtered air from the enclosures is exhausted back into the Controlled Area. Continuous air sampling heads are strategically located throughout the scrap recovery area to obtain representative samples of "breathing zone" air. DOP tests and face velocity measurements

1.9.6.8 (continued)

indicated by the differential pressure monitoring device on the incinerator control panel. It will also be indicated by the analyses of the stack samples. If this occurs, immediate shut down of the incinerator will be initiated manually so that appropriate corrective action can be taken.

As enumerated above, sufficient means are provided for immediate detection and correction of problems that could occur in the incinerator system. For this reason, adverse in-plant and offsite effects due to system failures are not considered likely.

8

1.9.7 Auxiliary Incineration System

1.9.7.1 Purpose of Incineration

Combustible waste may be treated by incineration to reduce the volume of waste disposed to licensed burial grounds and to permit the recovery of SNM when practical.

1.9.7.2 Typical Materials to be Incinerated

Typical materials are paper, plastic shoe covers, gloves, mops, plastic bags, tape, fiberboard containers, burnable liquids, etc. from licensee's various laboratories and fuel fabrication processes.

1.9.7.3 Incinerator System Location

The auxiliary incineration system is located in the Contamination Controlled Area of the Westinghouse Columbia Plant. The specific location is shown in Figure 1.9.0.1., Revision 8 (page 77).

1.9.7.4 Incinerator System Description and Operation

The incinerator is a controlled air, dual chambered, gas fired unit. The two chambers, ignition (lower) will operate at approximately 1500°F and the (upper) combustion chamber will operate at approximately 2000°F. In addition, the ignition chamber is equipped with a combustible liquid burner.

There is also a continuous Ash Removal System opening at the rear of the ignition chamber. Exhaust gases leaving the upper combustion chamber will be transferred into a Quench Tower.

1.9.7.4 Incinerator System Description & Operation (cont.)

The exhaust gases are sprayed with conditioned water and are condensed and cooled. This condensed liquid is adjusted for pH and reused in the gas scrubbing system.

Material movement through the auxiliary incineration system is described as follows:

1.9.7.4.1 Boxes of contaminated waste, with the amount of contamination recorded, will be delivered to the incinerator.

1.9.7.4.2 The boxes will be fed via a conveyor into the incinerator feed system.

1.9.7.4.3 The incinerator feed door will raise automatically as a hydraulic RAM pushes the box into the ignition chamber of the incinerator.

1.9.7.4.4 The feed system can be adjusted from four (4) boxes to twelve (12) boxes per hour.

1.9.7.4.5 Live steam may be injected into the chamber to assist control of the combustion process.

1.9.7.4.6 The gaseous products of the combustion at approximately 2000°F will enter the Quench Tower where the temperature will be lowered to approximately 160°F.

1.9.7.4.7 The gases will pass through a Venturi Scrubber section and into a HCl Acid Stripper (packed column).

1.9.7.4.8 The gas flow then travels through a condenser and any liquid removed is returned to the scrubber pump.

1.9.7.4.9 The dewatered exhaust gases are reheated by the duct heater before entering the HEPA filter house. All duct work between the condenser and the exhaust blower will be heated and insulated. The top, bottom and sides of the HEPA filter house will also be heated and insulated.

1.9.7.4.10 The exhaust blower will be mounted in the second floor equipment room with a stack up through the roof. An isokinetic probe will be installed a minimum of 5 duct diameters above the blower. A small back-up blower will be installed in parallel with the primary blower. The back-up blower will only operate when the primary blower fails. The back-up blower is only to permit an orderly shut-down.

1.9.7.5 Radiological Safety Control

The incinerator system is installed within the Contamination Controlled Area of the plant. Only authorized personnel are allowed into this area. Operating personnel are required to submit to the bioassay program for routine urinalyses. Lung burden determinations (subparagraph 3.2.3) and the use of external radiation exposure monitoring devices (subparagraph

1.9.7.5 Radiological Safety Control (cont.)

2.2.3) may also be required.

An isokinetic air sampler, described in subparagraphs 1.9.6.4 and 1.9.7.4.10 is installed downstream of the HEPA filters in the incinerator filter house. This air sampler continuously collects samples representative of the exhaust effluents discharged to the atmosphere. The samples are analyzed daily during operations. If the exhaust effluent at the point of release reaches a level of 2×10^{-12} microcuries per milliliter, an investigation will be made and the results evaluated. If the investigation reveals that 4×10^{-12} microcuries per milliliter may be exceeded as an annual average concentration, the cause will be determined and corrective action taken. These release and action limits are consistent with those applied to all other exhaust effluents.

Effluent exhaust concentrations from the existing incinerator have averaged less than 20% of MPC. The exhaust system for the new incinerator is expected to represent an improvement over the existing incinerator and thus lower exhaust concentrations even further.

Air sampling requirements for the incinerator will be evaluated in accordance with subparagraph 2.2.6 and 3.2.2 of this license. Permanently mounted continuous air sampling stations will be established

1.9.7.5 Radiological Safety Control (cont.)

where the greatest concentration of airborne activity is expected under adverse circumstances and consistent with operator work locations during the initial loading operations, and during ash removal operations. The exhaust blower maintains the combustion chambers at a negative pressure with respect to atmospheric. Under normal conditions, the combustion chamber will operate at a negative pressure of 0.1 " H_2O or more. The exhaust system will be maintained (filter change, scrubber maintenance, etc.) to assure that this minimum negative pressure drop of 0.1 " H_2O is maintained. This should be sufficient to ensure adequate containment since the combustion chambers are relatively air tight to assure that a proper combustion atmosphere is retained. Minimum instrumentation and controls are described in subparagraph 2.2.12 of this license, and apply to the auxiliary incinerator. Incinerator ashes are continuously transferred from the combustion chamber directly to a ventilated enclosure. This is performed within containment under negative pressure. After transfer to an approved container, appropriate precautions will be exercised during removal of the containers to minimize airborne radioactivity. Typically, all ash handling will be conducted within a ventilated enclosure designed to meet the requirements of subparagraph 2.2.5 of this license.

1.9.7.5 Radiological Safety Control (cont.)

At any time, liquids from the scrubber can be manually or automatically transferred to the final filtration tank where it is combined with conversion operation process wastes. These materials are then pumped through an on-line monitor system where uranium content is determined and if within acceptable limits is pumped to the plant waste treatment facility. Here they are refiltered and discharged to the environment in accordance with the limits specified in 10CFR20.106.

Due to the increased efficiency and improvements on this new system, total discharges of wastes are expected to be decreased.

1.9.7.6 Nuclear Safety Control

The area is monitored by a criticality alarm station which is part of the plant system and alarms both throughout manufacturing areas and at the plant Health Physics Laboratory. The incinerator is operated on a nuclearly safe batch basis in accordance with the maximum permissible values of mass listed in Figure 2.3.2.1. The enrichment used to determine the maximum permissible mass will be the highest value assigned to any of the wastes accumulated for incineration. All associated equipment, such as the scrubber pump tank, heat exchanger, filter housing in the scrubber recirculating system, and the vacuum cleaner to be used for ash removal is designed for processing wastes having a maximum enrichment of 4.15 w/o ^{235}U.

1.9.7.6 Nuclear Safety Control (cont.)

However, if it becomes necessary to process wastes having enrichments between 4.15 w/o ^{235}U and 5.0 w/o ^{235}U, this equipment, (if required), will be resized and respaced in accordance with the applicable criteria given in Figures 2.3.2.1 through 2.3.2.4. In addition, the batch size will be appropriately reduced.

Combustible wastes delivered to the incinerator area are contained in 30-55 gallon, metal or fiberboard drums, or fiberboard boxes presently used for baled waste shipments. These containers of waste are scanned in a gamma counting facility. After scanning, the containers are stored in an area adjacent to the incinerator, under established criteria for the Contamination Controlled Area. The applicable storage criteria are those described in Paragraph 1.3.7.

Wastes accumulated without regard to origins are assumed to contain uranium having a maximum enrichment, normally 4.15% ^{235}U. Proper storage of this material and storage area posting requirements are monitored routinely by the Plant Criticality Engineer.

Waste accumulated with known origins or enrichments are assigned the known enrichment. They are stored correspondingly segregated in accordance with established operating procedures. Storage areas for these wastes are reviewed and approved by the manager of the Radiation Protection Component.

1.9.7.6 Nuclear Safety Control (cont.)

All containers are marked with grams of ^{235}U contained therein as determined by licensee's gamma counting facilities. Each container is limited to 350 grams ^{235}U reduced by 50% to reflect the measurement uncertainty associated with the gamma count.

The gamma counting facilities are calibrated at least monthly, and checked daily during counting operations, using phantoms loaded with known quantities of ^{235}U. Size and geometry of the phantoms are identical to those of the waste containers.

An incinerator log is maintained by the operator, indicating the ^{235}U content of waste charged to the system and ash removed from the system. Until the limit specified below is reached, waste can be charged. When the incinerator system is cleaned and the ash removed, the nuclearly safe containers of ash are gamma counted, the SNM content recorded in the log and a comparison made with the amount charged. The difference will be considered MUF and recorded in the log. Ash may also be analyzed chemically to verify the ^{235}U content.

A particular batch portion is not charged when the sum of such an additional charge plus the recorded quantity of MUF plus the amount already charged exceeds a nuclear safe batch of SNM reduced by 50% to reflect the measurement uncertainty. When this limit

1.9.7.6 Nuclear Safety Control (cont.)

reached, incinerator operations are suspended, ash removed and gamma counted, and a survey of the system made to measure any biases which may exist between the feed and ash counting steps. The recirculating scrubber solution can be sampled and analyzed by alpha proportional counting techniques. When loaded, HEPA filters are gamma counted in a similar manner as feed material. In addition, certain sections of the system may be surveyed visually, or with direct reading portable instruments. Alternatively, the MUF may be adjusted to zero after each burn. In this case, the ash would be removed and the entire incinerator system would be thoroughly cleaned, visually inspected, and surveyed for residual contamination prior to release by the Radiation Protection Component.

After operation of the incinerator, ash is removed with a vacuum cleaner or other means and loaded into containers such as polypaks, fiberpaks or metal pails. Both the vacuum cleaner and the ash containers are either limited to a nuclearly safe volume or a nuclearly safe diameter. The applicable maximum permissible values specified in Figures 2.3.2.2 and 2.3.2.3 respectively for 4.15 w/o homogeneous oxides will be used. The ash is gamma counted and a comparison of ash count with charge count is made and a MUF determined. Whenever the total MUF (initial plus adjustments) approaches the safe mass limit,

1.9.7.6 Nuclear Safety Control (cont.)

the system is thoroughly cleaned and, if necessary, new components are installed and the system is resurveyed to establish a new system (initial holdup) MUF.

Each container of ash is limited to a maximum of 350 grams ^{235}U reduced by 50% to reflect the measurement uncertainty. Containers of ash are stored in a designated section of the Contamination Controlled Area near the incinerator in accordance with the applicable nuclear criticality control criteria established in subparagraph 2.3.2.2. Ash may be processed for recovery of the SNM or disposed of to a licensed burial facility.

The wet scrubber system sump tank (water reservoir), filters and heat exchanger are each in the form of cylinders with an effective inside diameter of 10.2" or less. The heat exchanger is considered a flow through device and the sump tank and filters are spaced in accordance with surface density criteria. 10.2" is the maximum permissible cylinder diameter for 4.15 w/o material specified in Figure 2.3.2.3 for homogeneous material.

1.9.7.7 Safety Mechanisms

Safety controls exist in several areas of the system to insure safe operation of the system as well as control operational upsets and/or malfunctions that could occur. These are listed as follows:

1.9.7.7 Safety Mechanisms (cont.)

1.9.7.7.1 High temperature (approximate 250°F) detected in the Quench Tower Sump. Alarm Indication. Appropriate actions are taken to correct the situation.

1.9.7.7.2 Low indications in the scrubber system weir liquid flow. Alarm Indication. Appropriate actions are taken to correct the situation.

1.9.7.7.3 Low indication on system air flow. Alarm Indication. Appropriate actions are taken to correct the situation.

1.9.7.7.4 ΔP HEPA filter high. Alarm Indication. Appropriate actions are taken to correct the situation.

As enumerated above, sufficient means are provided for immediate detection and correction of problems that could occur in the incinerator system. For this reason, adverse in-plant and off-site effects due to system failures are not considered likely.

1.9.7.8 Improvements in the operation, logic and functional control of this system may be made as indicated by new regulations and/or operating experience.

1.9.8 Chemical-Manufacturing Development Laboratory

1.9.8.1 Purpose of Chemical-Manufacturing Development Laboratory

The purpose of the Chemical-Manufacturing Development Laboratory is to provide a separate area where development of processes and equipment can be accomplished with minimum impact on normal production operations. This area will be used for development, prototype development and equipment checkout prior to installation in the production operations.

1.9.8.2 Typical Operations That May Occur In the Development Laboratory

The three typical areas of operation that may occur are listed below:

1.9.8.2.1 Chemical Development such as Waste Treatment Studies, Uranium Chemical Processing, Uranium Recovery, etc.

1.9.8.2.2 Ceramic Development such as Powder Preparation and Characterization, Pellitization Studies, Sintering Studies, etc.

1.9.8.2.3 Mechanical Development such as Rod Loading Devices, Rod Plugging and Welding Development, etc.

1.9.8.3 Specific Examples of Development Operations

The following is an example of a development project that was conducted at the Columbia facility.

1.9.8.3 Specific Examples of Development Operations (cont.)

The development was conducted in one of the production lines during routine operations.

1.9.8.3.1 Pilot Furnace Testing

Sintering furnace testing is currently performed on production line furnaces when production schedules permit. The types of testing conducted in the past included binder studies, densification testing, etc. Many of these programs are delayed because of production schedules.

Again, a development laboratory would permit furnace testing independent of production and under controlled conditions. A development laboratory pilot sintering furnace would use enriched uranium under the same nuclear safety controls as production line furnaces, e.g. slab thickness and other controls to assure that loaded boats are not stacked beyond the allowable slab thickness.

Radiological safety will be assured by control of hydrogen and appropriate exhaust ventilation through HEPA filters. No unusual problems are anticipated.

1.9.8.4 Chemical-Manufacturing Development Laboratory Location

The Chemical-Manufacturing Development Laboratory is located in the Contamination Controlled Area of the Westinghouse Columbia Plant. The specific location is shown in Figure 1.9.0.1, Revision 8 (page 77).

1.9.8.5 Chemical-Manufacturing Development Laboratory Description

The laboratory will occupy approximately 4,400 square feet total area of floor space. It will be located adjacent to the Production Manufacturing Area and will be isolated by a wall or fence.

Services such as ventilation, water chemicals, etc. will be provided as needed. Equipment and operations used for development will be evaluated by the Radiation Protection Component for compliance with existing license and regulatory requirements prior to operation.

The laboratory will be monitored by the area criticality alarm system. The personnel bioassay program described in Section 3.2.3. will apply to persons working in this area.

1.9.8.6 Chemical-Manufacturing Development Laboratory Controls

The scope of projects anticipated for this area is necessarily very broad. This will require the following administrative controls to assure that radiological and nuclear safety concerns are addressed and appropriate controls are implemented.

In this regard, lines of organizational authority for the laboratory follow the philosophy outlined in subparagraph 3.1 of the license, i.e. line management is responsible for all aspects of the operations, including safety.

1.9.8.6 Chemical-Manufacturing Dev. Lab. Controls (cont.)

The radiation protection function's responsibility is to review all development work from a radiological and nuclear safety standpoint. All work involving radioactive materials require either an effective detailed procedure or a job safety analysis. Procedures are reviewed by the radiation protection function for radiological and nuclear safety. Whether the work is performed under approved procedures or job safety analyses, the responsible line manager is required to submit sufficient information to permit the proper review. The radiation protection function then issues the nuclear safety posting criteria and inspects installed equipment as appropriate.

Air sampling requirements for the laboratory will be evaluated in accordance with subparagraphs 2.2.6 and 3.2.2 of this license. Permanently mounted continuous air sampling stations will be established where the greatest concentration of airborne activity is expected under adverse circumstances and consistent with operator work locations. However, engineering controls will be used where possible to control airborne radioactivity at its source.

Ventilated enclosures are used as appropriate to control airborne concentrations. Examples include a walk-in ventilated hood for testing large pieces of equipment, small fume hoods, dust collectors, etc.

1.9.8.6 Chemical-Manufacturing Dev. Lab. Controls (cont.)

All enclosures will be designed and operated to meet the ventilation specifications in subparagraph 2.2.5 of this license; ventilation control procedures will conform to subparagraph 3.2.2 of this license.

1.9.9 PURIFICATION OF CONTAMINATED SCRAP THROUGH SOLVENT EXTRACTION

1.9.9.1 Purpose of Solvent Extraction

Contaminated uranium scrap may be purified through in-plant solvent extraction and thus virtually eliminate the shipment of uranium-bearing scrap material over the public highway system.

1.9.9.2 Typical Materials to be Purified Through Solvent Extraction

Typical materials are uranyl nitrate solutions prepared utilizing the following scrap components requiring purification. These include grease and oil contaminated UO_2, incinerator ash, oxidation furnace product, etc.

These scrap materials result from licensee's fuel fabrication process operations.

1.9.9.3 Solvent Extraction System Location

The solvent extraction system is located in the Contaminated Controlled Area of the Westinghouse Columbia Plant. The specific location is shown in Figure 1.9.0.1 Revision 8 (page 77).

1.9.9.4 Process Description and Equipment

1.9.9.4.1 Solvent Extraction System

1.9.9.4.1 Solvent Extraction System (cont.)

The solvent extraction system consists of scrap preparatory equipment, dissolver, mechanically pulsed extraction and strippi columns, product evaporator, a nitric acid recovery system, associated liquid storage vessels and related instruments and controls. Scrap uranium is charged to the dissolver in preweighed critically-safe batches where nitric acid and water dissolve the uranium and forms a uranyl nitrate solution. The dissolver product is filtered, adjusted to a maximum of 5 gm ^{235}U/liter in

nitric acid and pumped to the feed storage tanks. The concentration of ^{235}U is less 5 gm/liter in all other vessels. The dissolver tanks, adjustment tanks, and feed storage tanks meet the MPV for diameter criteria. All liquid transfer lines are less than 2 inches in diameter and do not require criticality consideration. The process flow diagram is shown in Figure 1.9.9.4.1.

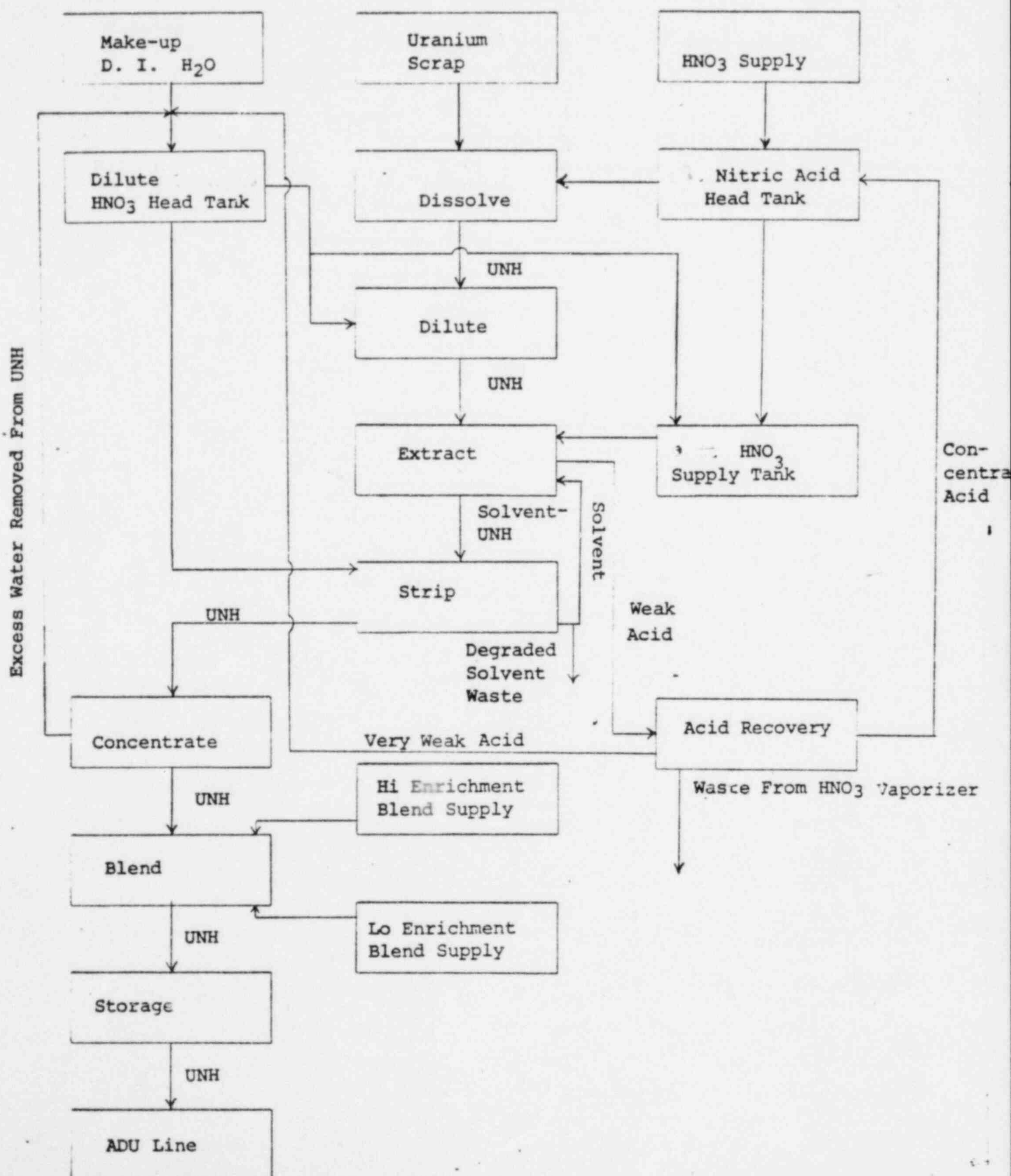
1.9.9.4.2 Preparatory Equipment

Prior to dissolution, uranium bearing scrap is treated to remove impurities such as volatile materials. These operations will include thermal processing, solids removal and

SOLVENT EXTRACTION

SYSTEM FLOW DIAGRAM

Figure 1.9.4.1



1.9.9.4.2 Preparatory Equipment (cont.)

concentration of the scrap materials. Thermal processing and concentration will be conducted in oxidation furnaces on a batch basis. Solids removal will be incorporated into the dissolver system which is discussed below.

1.9.9.4.3 Dissolution

Dissolution is performed in a series of nuclearly safe diameter tanks designed to sequentially dissolve the scrap in a nitric acid solution and settle out the non-dissolved solids. The dissolved scrap is then transferred to nuclearly safe diameter storage tanks where it is diluted prior to transfer to the extraction column.

1.9.9.4.4 Extraction

Uranium is extracted from the acidified feed solution in a four inch safe diameter column containing spaced sieve plates and pulsed by a piston pump. The extracting solvent is a tributyl phosphate (TBP) mixture. The solvent mixture is metered into the top of the column. The uranium-bearing aqueous feed is charged in slightly below the column midpoint and flows toward the top of the column counter-current to the solvent mixture flow.

1.9.9.4.4 Extraction (cont.)

A nitric acid scrub solution flows into the bottom of the column and toward the top of the column combining with the aqueous feed stream in the upper region of the column. Superimposed on these stream flows is an oscillation provided by the pulsing pump which forces the liquids back and forth through the sieve plate holes creating a dispersion of solvent droplets in the aqueous continuum. The uranium transfers from the aqueous phase into the solvent phase aided by the "salting out" action of the excess nitric acid present. The extracted aqueous phase collects in a "quiet zone" provided at the top of the column, overflows into a ten inch nuclearly safe diameter holding tank and is directed through a solvent trap to a nitric acid recovery unit. A radiation detector monitors the column overflow and automatically shunts the stream into a ten inch nuclearly safe diameter auxiliary tank for recycle to the feed tanks if a high uranium content is indicated (> 1 gram U-235 per liter). The uranium laden solvent phase collects in a quiet transition zone provided at the bottom of the column and then flows to the top of the stripping column.

1.9.9.4.5 Uranium Stripping

The uranium laden solvent from the extraction column flows into the top of a six inch safe diameter column containing spaced sieve plates and pulsed by a piston pump. The solvent phase flows toward the bottom of the stripping column counter-current to a stream of weakly acidic nitric acid. stripping water that is metered into the bottom of the column. Superimposed on the flows of these two streams is an oscillation provided by the pulsing pump which forces the liquids back and forth through the sieve plate holes creating a dispersion of solvent droplets in the aqueous phase. The uranium transfers from the solvent phase into the stripping water. The uranium laden stripping water collects in the transition zone provided at the top of the column and overflows through a solvent trap into a ten-inch nuclearly safe diameter holding tank. This uranium solution contains (35-100) gms U/liter The stripped solvent collects in a transition zone provided at the bottom of the stripping column and flows into a ten-inch nuclearly safe diameter cylindrical holding tank. From there it recycles to the extraction column again to extract uranium from a new increment of feed.

1.9.9.4.6 Uranyl Nitrate Concentration

Dilute aqueous phase product from the stripping column is transferred into a safe diameter, cylindrical, flash evaporater in order to remove excess water from the uranium solution. The evaporated water is condensed and recycled to a storage tank for reuse in the extraction process. The uranyl nitrate product, concentrated to a maximum of 5 gm U235/liter, is pumped from the evaporator to product holding tanks (10 inch nuclearly safe diameter cylinders) where it is sampled for isotopic content, acidity (as free HNO_3) and uranium content.

Adjustments to acid content and isotopic content (when needed) of the product are continuously made as the product moves through a ten-inch safe diameter cylindrical mixing tank. The material is then sent to product storage tanks for use in the uranium conversion lines.

1.9.9.4.7 Nitric Acid Recovery

The aqueous effluent from the extraction column is transferred into a nuclearly safe diameter cylindrical evaporator which vaporizes almost all of the liquid. A small amount of liquid is necessary to keep the

1.9.9.4.7 Nitric Acid Recovery (cont.)

metal salts carried by the effluent in a slurry solution. The vapor stream is piped into a safe diameter distillation column which separates the nitric acid as approximately 68% acid and this is returned to a storage tank for reuse in the uranium scrap dissolver. The distillation overhead, which is essentially water, is recycled to a storage tank for reuse in the extraction process.

1.9.9.4.8 Process Waste Treatment

Tank vents are connected to the plant vessel ventilation system which controls atmospheric pullutants to the lowest practical level. Non-condensable off-gas from the uranyl nitrate evaporator and nitric acid still are removed through the plant vessel ventilation system. The vessel ventilation system contains a direct contact, recirculating, venturi scrubber with a liquid disengagement section followed by a demister and finally, HEPA filters prior to discharge of gases to the atmosphere. Filtered gases discharged to the atmosphere are continuously sampled and are analyzed for airborne particulate radioactivity on a daily basis. Scrubber

1.9.9.4.8 Process Waste Treatment (cont.)

water is transferred to the final filtration tanks where it is combined with conversion operations process wastes. These materials are then pumped through an on-line monitor system where uranium content is determined and if within acceptable limits is pumped to the plant waste treatment facility. No routine liquid discharges from the solvent extraction system are expected to be processed through the plant waste treatment facility.

A periodic solvent renewal of approximately 30 gallons for each 300 hours of column operation is expected to be needed. The spent solvent mixture is drawn from the holding tank into a drum and replenished with fresh solvent mixture.

The preferred method of disposal of the degraded solvent will be to wash the spent solvent solution with a sodium carbonate solution to remove the degradation products and then reuse the solvent in the process. Two additional possibilities for disposal of the spent solvent exist: (1) further salvage uranium from the spent solvent such that the material may be disposed of as

1.9.9.4.8 Process Waste Treatment (cont.)

non-radioactive chemical waste, (2) absorb the liquid in vermiculite and ship to a licensed burial facility.

The metal salt slurry residue from the nitric acid recovery vaporizer also contains traces of uranium. This slurry will be treated with a sodium carbonate solution to further remove uranium from this material. The remaining residue will be disposed of through burial. The carbonate solution containing the salvaged uranium will be transferred to scrap recovery operations in order to recover the uranium for use in production operations. All other streams from the solvent extraction process are internally recycled as described in previous paragraphs.

1.9.9.5 Radiological Safety Control

The solvent extraction system is installed within the Contamination Controlled Area of the plant. Only authorized personnel are allowed into this area. Operating personnel are required to submit to the bioassay program for routine urinalyses. Lung burden determinations and the use of the external radiation exposure monitoring devices

1.9.9.5 Radiological Safety Control (cont.)

may also be required.

Permanently mounted, continuous air samplers are located at points within the system where greatest concentration of airborne activity is expected under adverse circumstances and the points where operators work during routine operation of the system.

All tanks, columns, enclosures and furnaces will be ventilated into the existing plant exhaust system.

All tanks and columns will be vented into the present scrap recovery scrubber system as described in subparagraphs 1.9.4.2, 1.9.4.5 and 1.9.4.7 (non-proprietary) of the license. Treatment of these off gases include scrubbing and HEPA filtration.

Ventilated enclosures used for containment of dry scrap will be directed through the existing plant exhaust system which includes HEPA filtration. An average of 100 lfpm will be maintained across all openings. Ventilation control procedures and administrative controls are described in subparagraphs 2.2.5 and 3.2.2 of the license.

1.9.9.5 Radiological Safety Control (cont.)

With the effluent treatment described above, no significant increase in exhaust concentration is expected.

1.9.9.6 Nuclear Safety Control

The nuclear safety of the system is assured on the basis of safe mass, concentration, geometry, volume and by solid angle criteria. The double contingency criteria is met by solid angle criteria and one or more of the MPV's for mass, concentration, geometry or volume.

The dissolver is identical with the ones now used in Dissolution Operations Section 1.9.4.2 (non-proprietary) of the license and are operated on a safe mass basis. All solutions down stream of the dissolver are 5 gm U235/ liter so that neutron interaction is of limited concern. All process vessels and equipment meet the MPV's for diameter criteria.

Solid angle analyses were performed using solid angle criteria as given in TID-7016, Revision 1, and the supplemental reflector conditions as specified in Subparagraph 2.3.2.2 of the license. Figure 1.9.9.4.1 shows the layout and center element and table 1.9.9.4.1 shows the center-to-edge separation

1.9.9.6 Nuclear Safety Control (cont.)

distances between the center element and other process vessels and equipment. Although the geometric centers of all the process vessels and equipment are not in the same plane, all separation distances were conservately assumed to be at right angles with respect to the lines joining their geometric centers with that of the center element.

All subcrits were reduced to cylindrical geometries on an equivalent cross-sectional area basis using the formula W= (sinΘ), from TID-7016, Revision 1. No distinction was made between horizontally and vertically oriented subcrits. That is, the orientation of all subcrits was assumed to be vertical.

Solid angle calculations were made assuming three (3) different vessels V-1081, T-1087 C and T-1087 D to be the central subcrit. The K_{eff} for each of the central subcrit vessels was determined to be 0.580 from the curve shown in Figure 2.3.2.13 of the license. The solid angle for T-1087 C was the largest for the central subcrits and was determined to be 2.5748 steradians which is 80.5% of the maximum allowable value. The layout,

1.9.9.6 Nuclear Safety Control (cont.)

therefore, satisfies the solid angle criteria.

The area is monitored by two criticality alarm stations of the plant gamma alarm system with dual scintillation detectors and three siren type audible alarm horns.

Tanks which exceed the MPV for cylinder diameter criteria such as the HNO_3 head tanks are vented to preclude an inadvertent vacuum transfer of uranium bearing solution from the process vessels to the tanks. All process vessels are vented into a safe geometry scrubber.

1.10 Off-site Release Evaluations

Westinghouse has postulated a variety of accidents in the handling of large quantities of source and low enriched special nuclear materials and has found the consequences of any of them to be well within established guidelines. The most significant type of accident would be a release of an appreciable quantity of radioactive material off site. A quantity of uranium may be established, which, if released, would produce a downwind concentration at ground level equal to the maximum allowable concentration specified in 10 CFR 20.106(a).

2.2.1 (continued)

Four emergency standby generators with rated capacities of 250 kw, 300 kw, and two at 500 kw will be maintained. The standby generators will be activated automatically in the event of a facility power outage. 8

2.2.2 Emergency Equipment

Equipment required to cope with a radiation emergency will be kept at designated locations and will be sufficient to provide emergency personnel adequate radiation protection to meet the requirements of 10 CFR 20 during corrective activities.

Film and/or TLD badges and pocket dosimeters capable of detecting and measuring gamma and x-radiation will be * available to emergency personnel. Portable instrumentation, which is available at various locations on the site for the evaluation of beta-gamma radiation, will have capabilities over the range of 0.1 mR/hr - 300 R/hr.

Personnel protective equipment, such as respirators, self-contained breathing apparatus and protective clothing; and other required equipment, such as signs, rope or tape for marking exclusion areas, smear papers, blank data forms, and floor plans of buildings including equipment layout will also be maintained.

2.2.3 Personnel Monitoring Devices

Film badges or thermoluminescent dosimeters (TLD's) provided * by a commercial supplier, capable of detecting and measuring gamma and x-radiation will be used. In addition, neutron * detection capability will be available when specified by the radiation protection function.