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AIRBORNE EXPRESS

21G-02-0310
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ACF-02-0245

October 11, 2002

Director
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

References:
1) Docket No. 70-143; SNM License 124
2) Letter from B.M. Moore to NRC, Licensing Plan of Action to Support the Blended Low Enriched Uranium Project at Nuclear Fuel Services, dated October 4, 2001 (21G-01-0180)
3) Letter from NRC to B.M. Moore, Nuclear Fuel Services, Inc., Amendment 31 (TAC No. L31535) to Approve Integrated Safety Analysis Plan and Delete License Conditions S-28 through S-38, dated October 30, 2001
4) Letter from B.M. Moore, Supplemental Environmental Report for Licensing Actions to Support the BLEU Project, dated November 9, 2001 (21G-01-0261)
5) Federal Register, Consideration of License Renewal Request for Nuclear Fuel Services, Inc., (Vol. 64, No. 23, pp. 5681-5683), issued February 4, 1999
6) Federal Register, Environmental Assessment and Finding of No Significant Impact of License Amendment for Nuclear Fuel Services, Inc., (Vol. 67, No. 131, pp. 45555-45558), issued July 9, 2002

Subject: License Amendment Request for BLEU Preparation Facility

Dear Sir:

Nuclear Fuel Services, Inc. (NFS) hereby requests an amendment to the referenced license to authorize: (1) modifications to special nuclear material (SNM)-processing operations in the BLEU Preparation Facility (BPF) at Building 333 and (2) minor administrative changes. The request contained herein is the second of three license amendment applications that will be needed to support operations associated with downblending and conversion of High-Enriched Uranium (HEU) materials to Low-Enriched Uranium (LEU) oxides at NFS, as described in Reference 2.

NMSS01

Page changes to Parts I and II of the referenced license are contained in Attachment I. Changes to portions of the referenced license concerning NFS' organization and administration, health physics and nuclear criticality safety programs, decommissioning activities and the emergency plan were not required.

A summary of the proposed changes to License SNM-124 follows:

- Chapter 1, Appendix D: Reference to EcoTek LSI and EcoTek Engineering Services of Ohio, Inc. were deleted, as these corporations are no longer NFS Affiliate corporations.

- Chapter 5 – Environmental Protection: Several changes to the environmental safety program were necessary to reflect alternative sampling locations due to decommissioning the 200 Complex. As such, reference to the "Non-Contact Cooling Water" sampling location was deleted from Table 5.1 and throughout applicable sections of Chapter 5. In addition, an administrative change to this table was necessary to specify the correct units (μCi/ml) of radioactivity that comprise "Action Level" and "Typical MDC" values.

  Other minor changes were made to Sections 5.1.2 "Liquid Effluents" and 5.2.7 "Ground Water Monitoring". The BPF was added to Chapter 5, Section 5.1.2 to reflect that liquid effluents would be treated at the Waste Water Treatment Facility (WWTF) and discharged to the Nolichuckey River in accordance with NFS' National Pollutant Discharge Elimination System permit.

  Reference to the two, 6000-gallon tanks described in Chapter 5, Section 5.2.7 was deleted because use of these tanks has been discontinued. However, sampling of the downgradient groundwater monitoring wells will continue, as described in this section of the referenced license.

- Chapter 6, Section 6.5.4 - Enrichment Blending System: Due to decommissioning the 200 Complex, NFS has been relocating some of the downblending equipment to the BPF located at Bldg. 333. Therefore administrative changes have been made to Chapter 6, Section 6.5.4 "Enrichment Blending System". References to "Building 233", the specific feed columns, and "Tank 9" have been deleted. No other changes were necessary to support operations at the BPF.

- Chapter 10, Section A, Plant Layout: Minor editorial changes to this section were necessary. Section 10.1.17 was added to describe process operations that would be present at the BPF.

- Chapter 10, Section C, Ventilation – HVAC: The flow rates for the BPF HVAC system were added to this section.

- **Chapter 10, Section D, Ventilation – HEURF:** Only minor changes were needed to discern between the ventilation systems operated in support of the HEURF and those at the BPF and KAST.

- **Chapter 10, Section G, Other Facilities:** This section was revised to include the BPF. A complete description of the process ventilation system that will be installed to support the BPF is provided in the BPF ISA Summary.

- **Chapter 10, Section H, Waste:** Wastewater from the BPF will be treated at the WWTF and, therefore, only a minor change to this section of the license was required.

- **Chapter 10, Section I, Fire Protection:** Added the fire suppression and fire detection systems that would be installed at the BPF to Table 10.1. Other changes include minor editorial revisions.

- **Chapter 13, Section A, Environmental Protection:** References to the NFS Supplemental Environmental Report for the BLEU Project and NRC's Environmental Assessment and Finding of No Significant Impact (EA/FONSI) are included. These changes reflect the licensing actions that were required to authorize construction of the Uranyl Nitrate Building, justify an increase of the ^{235}U possession limit, and address radiological and environmental impacts attributable to the BLEU Project. Other minor changes were made to denote updates and changes to environmental sampling locations.

- **Chapter 15, Section 13, BLEU Preparation Facility – Building 333:** A new section was added to describe the process operations that will occur at the BPF. Please note that safety features described in the BPF ISA Summary are cross-referenced in Section 13, but are not repeated to avoid duplicity.

The NFS Safety and Safeguards Review Council has reviewed and approved these changes. For your convenience, vertical lines in the right-hand margin of affected license pages denote changes.

Based on evaluations performed against criteria specified in Title 10, Code of Federal Regulations (CFR) Part 70.72, and License Condition S-25, this license amendment application consists of process steps involving HEU-aluminum alloy dissolution and enrichment downblending. As required under 10 CFR 70.61, the content of the license amendment application includes an integrated safety analysis (ISA) summary (Attachment II) that was prepared in a manner consistent with Reference 3. This ISA summary is considered proprietary information, as set forth in the enclosed affidavit; therefore, NFS requests that this information be withheld from public disclosure. A non-proprietary version of this ISA summary suitable for public disclosure is contained in Attachment III.

A decommissioning cost estimate is included (Attachment IV) for the BPF, as required under Chapter 7.2.3 of the referenced license. As discussed with your staff, NFS will institute a financial assurance instrument specified in 10 CFR 70.25, once the amount of financial assurance funding is deemed acceptable by the NRC and prior to possessing SNM at the BPF. The decommissioning financial assurance cost estimate is considered proprietary information, as set forth in the enclosed affidavit; therefore, NFS requests that this information be withheld from public disclosure.

The drawings enclosed herewith have the following statement affixed:

> *"This drawing and all information contained thereon is the property of Nuclear Fuel Services, Inc. and shall not be used or disclosed for any purpose other than that for which it has been furnished without the express written consent of NFS."*

Notwithstanding the language of this restriction, NFS acknowledges that reproduction and controlled distribution of submitted documents, in accordance with NRC regulations and requirements, is necessary in order for the NRC to carry out its legal and regulatory responsibilities. Further, NFS acknowledges that reproduction and controlled distribution of these drawings by a third party authorized by the NRC is allowable by this language. Therefore, it is NFS' position that the enclosed drawings may be reproduced and distributed in a controlled manner, by a third party authorized by the NRC, for NRC's purposes and use without violation of the statement above.

The NRC previously assessed environmental impacts for downblending and conversion processes at NFS during renewal of the referenced license. A Supplemental Environmental Report (Reference 4) supporting the BPF operations was also reviewed by the NRC. The NRC also issued an Environmental Assessment and Finding of No Significant Impact (EA/FONSI) for the renewal of SNM-124 and an EA/FONSI for the BLEU Project (References 5 and 6). Since NFS previously submitted information to support the NRC's environmental review of the entire BLEU Project, no additional information is contained herein.

To streamline the licensing process, NFS has submitted the following additional information to the NRC under separate cover letters:

- Revisions to the Physical Safeguards Plan (24Y-02-0018)
- Revisions to the Fundamental Nuclear Material Control Plan (30Y-02-0072)
- Revisions to the NFS Emergency Plan (21G-02-0313)

NFS requests the license amendment be issued by July 1, 2003, as described in Reference 2. NFS appreciates the efforts of your staff in supporting the licensing of this very important project.

If you or your staff have any questions, require additional information, or wish to discuss this, please contact me, or Mr. Rik Droke, Licensing and Compliance Director at (423) 743-1741.

Please reference our unique document identification number (21G-02-0310) in any correspondence concerning this letter.

Sincerely,

NUCLEAR FUEL SERVICES, INC.

B. Marie Moore
Vice President
Safety and Regulatory

JSK/lsn
cc:
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Mr. Dan Rich
Senior Resident Inspector
U.S. Nuclear Regulatory Commission

ENCLOSURE

AFFIDAVIT

I, Richard L. Booth, Vice President of Corporate Services at Nuclear Fuel Services, Inc. (NFS), make the following representations that to the best of my knowledge and beliefs:

1. The following documents which Nuclear Fuel Services, Inc. (NFS) wishes to have withheld from public disclosure, are:

   Attachments II and IV to NFS letter B. M. Moore to Director, NMSS, dated October 11, 2002 (21G-02-0310), in their entirety.

2. The information contained in the documents cited in 1 above has been held in confidence by Nuclear Fuel Services, Inc. (NFS) in that it is of a privileged and confidential commercial nature.

3. The information contained in the documents cited in 1 above is the intellectual property of Nuclear Fuel Services, Inc. (NFS) and as such is customarily held in confidence by Nuclear Fuel Services, Inc. (NFS). Nuclear Fuel Services, Inc. (NFS) has customarily submitted privileged and confidential information of this type to the Nuclear Regulatory Commission (NRC) and to its predecessor, the Atomic Energy Commission (AEC), in confidence.

4 The information contained in the documents cited in 1 above has not been made available to public sources by Nuclear Fuel Services, Inc. (NFS), nor has Nuclear Fuel Services, Inc. (NFS) authorized that it be made available.

5 The public disclosure of the information contained in the documents cited in 1 above is likely to cause substantial economic harm to Nuclear Fuel Services, Inc. (NFS).

10/11/02

Richard L. Booth Date
Vice President
Corporate Services

I certify the above named person appeared before me and executed this document on this the 11th day of October, 2002.

Nitomi L Lewis
Notary Public

My commission expires: 09/29/04

Attachment I
Page Changes to SNM-124

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APPENDIX D

to SNM-124, Chapter 1
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NUCLEAR FUEL SERVICES, INC.
AFFILIATES

1. NFS Services, LLC., is a limited liability company which owns 100% of the stock of NFS Holdings, Inc.

2. NFS Holdings, Inc., is a corporation which owns 100% of the stock of Nuclear Fuel Services, Inc., and NFS Technologies, Inc., and the majority of Creative Energy Group, Inc. stock.

3. Creative Energy Group, Inc., is a subsidiary of NFS Holdings, Inc., which is engaged in comprehensive public and media relations services. Company established in 1992.

4. NFS Technologies, Inc., is a corporation which owns the majority of the stock of NFS-RPS, Inc., and 100% of the stock of Advanced Recovery Systems, Inc. NFS Technologies, Inc., conducts no business other than the holding of corporate stock.

5. NFS-RPS, Inc., Old Lyme, Connecticut, is a majority owned subsidiary of NFS Technologies, Inc., which supplies contamination control and safety products and provides services and software for the nuclear industry.

6. Advanced Recovery Systems, Inc., is a wholly owned subsidiary of NFS Technologies, Inc., which is engaged in treatability studies related to resource recovery and waste treatment processes. The company has no employees and is not an operational entity.

7. Nuclear Fuel Services, Inc. (NFS), is a manufacturer and processor of specialty nuclear fuels which is also engaged in decontamination, decommissioning, and remediation services for the chemical and nuclear industry. These services are performed both at NFS' Erwin, Tennessee, location and at other facilities.

8. NFS International, Inc., Erwin, Tennessee, is a wholly owned subsidiary of Nuclear Fuel Services, Inc., which is engaged in the potential processing and handling of foreign nuclear materials. The company was established by NFS in 1994, but has no current foreign contracts and no employees.

Figure D-1
NFS Corporate Structure

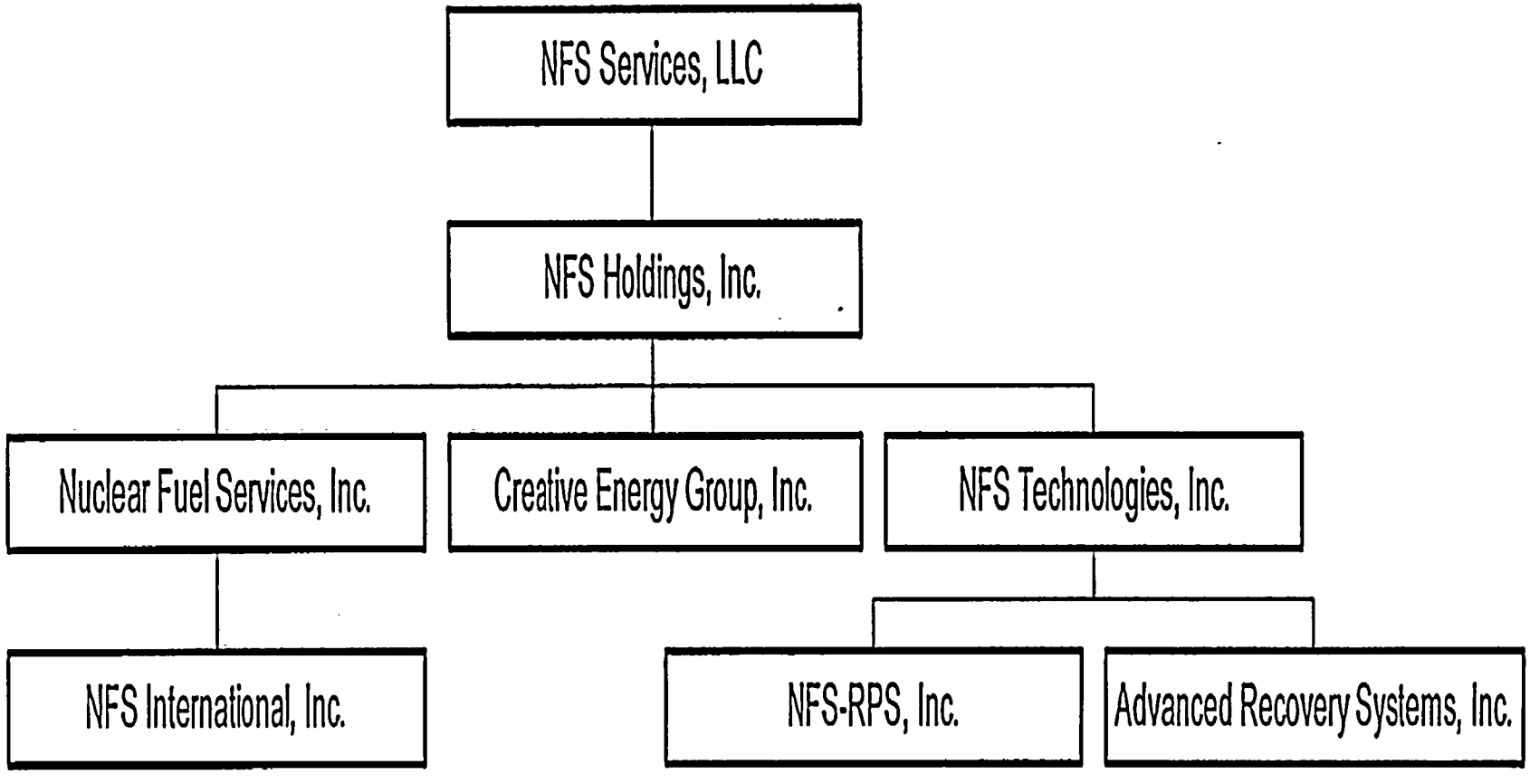


Table 5.1 Summary Table of Environmental Radiological Monitoring Program

Sampling Point	Sample Type/ Collection Frequency	Parameters Analyzed	Action Level (µCi/ml, unless otherwise stated)	Typical MDC (µCi/ml, unless otherwise stated)
Airborne Effluents[1]				
Operating Radiological Stacks[2]				
Main Processing Stack	Continuous/Daily[3]	Gross Alpha	Cumulative > 16.5 mCi/12-months Monthly Average > 2.0E-11	8.0E-14
		Gross Beta	Cumulative > 3800 mCi/12-months Monthly Average > 4.7E-9	1.0E-13
Combined Releases from Other Uranium Stacks	Continuous/Daily[3]	Gross Alpha	Cumulative > 1.8 mCi/12-months Monthly Average > 2.0E-12	8.0E-14
		Gross Beta	Cumulative > 270 mCi/12-months Monthly Average > 2.9E-10	1.0E-13
Combined Releases from Plutonium Stacks (Bldg 234)	Continuous/Weekly	Gross Alpha	Cumulative > 0.1 mCi/12-months Monthly Average > 7.0E-13	8.0E-15
		Gross Beta	Cumulative > 0.3 mCi/12-months Monthly Average > 1.9E-12	1.0E-14
Ambient Air*	Continuous/Weekly	Gross Alpha	Quarterly Average > 5.0E-15	3.0E-15
		Gross Beta	Quarterly Average > 9.0E-11	1.0E-14
	Composite/Quarterly	Isotopic U	Total U > 5.0E-15	4.0E-16
	Composite/Annually	Isotopic Th	Total Th > 4.0E-16	1.0E-16
		Isotopic Pu	Total Pu > 2.0E-15	1.0E-16
Liquid Effluents				
Surface Water				
Banner Spring Branch Upstream	Grab/Quarterly	Gross Alpha	Sample > 3.0E-8	1.0E-08
		Gross Beta	Sample > 3.0E-6	2.0E-08
Martin Creek Upstream	Grab/Quarterly	Gross Alpha	Sample > 3.0E-8	1.0E-08
		Gross Beta	Sample > 3.0E-6	2.0E-08
Nolichuckey River Upstream	Grab/Quarterly	Gross Alpha	Sample > 3.0E-8	1.0E-08
		Gross Beta	Sample > 3.0E-6	2.0E-08
Banner Spring Branch Downstream	Continuous/Daily[3]	Gross Alpha	Sample > 3.0E-7	1.5E-08
		Gross Beta	Sample > 6.0E-6	3.0E-08
	Composite/Monthly	Isotopic U	Sample SOF > 1.0 (see note 4)	1.00E-09
Martin Creek Downstream	Grab/Weekly	Gross Alpha	Sample > 3.0E-7	1.5E-08
		Gross Beta	Sample > 6.0E-6	3.0E-08
Nolichuckey River Downstream	Grab/Quarterly	Gross Alpha	Sample > 3.0E-7	1.5E-08
		Gross Beta	Sample > 6.0E-6	3.0E-08
Process Waste Water				
Waste Water Treatment Facility	Grab/each batch	Gross Alpha	Batch > 3E-7	1.5E-07
		Gross Beta	Batch > 6E-5	6 0E-07
	Composite/Monthly	Isotopic U	Semiannual Average SOF > 1.0 (see notes 4 and 7)	1.00E-09
Sanitary Sewer	Continuous/Daily[3]	Gross Alpha	Sample > 3.0E-7	1.5E-08
		Gross Beta	Sample > 6.0E-6	3.0E-08
	Composite/Monthly	Isotopic U	Sample SOF > 0.5 (see note 4)	1.0E-09
Ground-Water Treatment Facility (Discharges to Sewer)	Composite/Monthly (filtered insoluble material)	Gross Alpha	> insoluble radioactivity in background water	3.0E-08
		Gross Beta	Same as above.	5.0E-08
Other Environmental Media				
Sludge (Erwin POTW)	Grab/Quarterly	Isotopic U	Sample >30 pCi/g Total U	1 pCi/g
Soil	Grab/Quarterly	Gross Alpha See note 5	Sample > 25 pCi/g	5 pCi/g
Silt/Sediment	Grab/Quarterly	Gross Alpha See note 5	Sample >25 pCi/g	5 pCi/g
Vegetation	Grab/Quarterly	Gross Alpha See note 5	Sample >25 pCi/g	5 pCi/g
Groundwater	Grab/Quarterly	Gross Alpha Gross Beta See note 5	Sample > 15 pCi/liter Sample > 50 pCi/liter	10 pCi/L 15 pCi/L

Notes:

1. To minimize interference of radon progeny, air samples may be counted after a holding period (e g , 7 days) or decay-corrected prior to comparing to action levels and reporting final results
2. Radiological stacks and vents are considered to be those with a potential for releasing airborne activity at concentrations greater than or equal to 10% of the values in 10 CFR 20, Appendix B, Table 2, Column 1.
3. Daily means normal operating days, Monday-Friday, excluding holidays and weekends. On holidays and weekends samplers will continue to accumulate a sample; however, the sample will not be collected until the next normal operating day.
4. SOF = Sum of Fractions for the mixture of radionuclides. The SOF is determined by computing the sum of the ratios of various nuclides divided by their applicable effluent concentration value in Appendix B, Table 2, Column 2 to 10CFR Part 20.
5. If an action level is exceeded for this media, isotopic analysis will be performed on the sample (or a sample from the same location if the initial sample volume is insufficient)
6. The bases of all action levels and minimum detectable concentrations are documented and available for review.
7. If the SOF (WWTF) exceeds 1.0, results of a dose assessment to maximum exposed offsite receptor will be reported as indicated in paragraph 2 of Section 5.1.2.3.

Code (U. S. Department of Energy [DOE]), or an equivalent methodology. Site specific meteorological data will be used in the assessment when available. Otherwise, conservative values will be used for meteorological parameters. Air samples may be analyzed for uranium lung solubility class and enrichment in order to characterize the material released. Otherwise, conservative values will be used for solubility class and enrichment. NFS will follow written procedures to perform the calculations. Parameter values used in modeling shall be based on data collected during the assessment period, previous monitoring history, or the professional judgment of an environmental scientist or health physicist.

5.1.2 Liquid Effluents

Most process waste water is collected in tanks in or near the various process buildings. Prior to pumping these wastes to the Waste Water Treatment Facility (WWTF), they are analyzed and must show levels below internal action guide limits. Waste water generated in the following processes/ facilities, at a minimum, shall be treated in the WWTF.

- Fuel Manufacturing Facility
- High-Enriched Uranium Recovery Facility
- Low-Enriched Uranium Recovery Facility
- Laboratory Wastes (Bldg. 105)
- Decontamination Laundry
- Fuel Development Facility
- BLEU Preparation Facility

The WWTF is operated in accordance with a State of Tennessee issued NPDES permit. Waste water is treated in the WWTF on a batch basis with discharge directly to the Nolichucky River. The specific process description is included in Chapter 15.

NFS shall notify US NRC - Region II, Administrator of any violation of the NPDES permit in writing within 30 days of determination of the event.

When necessary for draw-down or treatment purposes, groundwater may be pumped and treated in the Groundwater Treatment Facility (GWTF). Water processed by this facility is discharged to the sanitary sewer. The specific process description is included in Chapter 15.

Discharges to the sanitary sewer system include: groundwater treatment facility effluents, BLEU Complex treated process wastewater, all plant bathrooms, and plant showers. Sanitary sewer discharges to the City of Erwin - Publicly Owned Treatment Works (POTW), are conducted in accordance with a formally issued pretreatment permit.

Storm water drainage from NFS' main plant site drains into Banner Spring Branch. Storm water from NFS' BLEU Complex drains into a culvert which parallels the northwest plant boundary and subsequently empties into Martin Creek. Because there is a possibility for contamination outside the buildings during transport of contaminated material between buildings, through dispersion by people, and through fallout from gaseous effluents, these sources are considered as liquid effluent. Samples are collected in Martin Creek and Banner Spring Branch at points downstream from all Plant inputs.

Liquid effluents that do not go through the Waste Water Treatment Facility shall meet the unrestricted area requirements of 10 CFR 20. See Table 5.1 for collection frequencies, analyses required, action levels, and minimum detectable concentrations.

5.1.2.1 Source-Point Sampling of Liquid Effluents

All process wastes liquids are collected and treated, if necessary, prior to discharge.

During the operation of the Waste Water Treatment Facility, each batch is analyzed for gross alpha and gross beta radioactivity prior to discharge. A monthly composite sample is analyzed for isotopes of uranium. The monthly composite will be analyzed for other radionuclides if materials in addition to uranium are suspected to be present in process waste water at levels exceeding 10% of the concentration values in Appendix B, Table 2, Column 2, 10 CFR Part 20. The chemical parameters prescribed in the State of Tennessee NPDES permit are also analyzed at least on the frequency specified in the permit. Samples of the treated waste water are collected from the final neutralization or storage tank prior to discharge.

When operating, a monthly composite sample of the Groundwater Treatment Facility is collected and analyzed for insoluble alpha and beta radioactivity. A method published by the American Public Health Association [e.g., Method 7110, ''Gross Alpha and Beta Radioactivity (Total, Suspended, and Dissolved)' ' in Standard Methods for the Examination of Water and Wastewater, 18th Edition] will serve as underlying guidance for the analysis.

Sanitary wastes are collected in two main pipes, (one for the BLEU Complex and one for the remainder of the main NFS plant site) for discharge to the Erwin-POTW. Samples are collected daily and analyzed for gross alpha and gross beta activity as outlined on Table 5.1. In addition, a monthly composite sample is collected and analyzed for isotopic uranium. The monthly composite will be analyzed for other radionuclides if materials in addition to uranium are suspected to be present in sanitary effluents at levels exceeding 10% of the concentration values in Appendix B, Table 2, Column 2, 10 CFR Part 20. In addition, sludge samples will be collected at the Erwin POTW. These samples will be collected at least quarterly (provided a blowdown sample is available) and analyzed for isotopic uranium.

With the exception of the BLEU Complex, the plant storm water drainage system runs into Banner Spring Branch. Subsequently, the flow enters Martin Creek, North Indian Creek, and then the Nolichucky River. The storm water drainage system at the BLEU Complex discharges into culverts which parallel the northwest plant boundary and empty into Martin Creek, and subsequently into North Indian Creek and then the Nolichucky River. Samples are taken at Banner Spring Branch (excluding runoff from the BLEU Complex), Martin Creek and the Nolichucky River, as outlined in Table 5.1. The downstream Banner Spring Branch daily samples are composited monthly and analyzed for uranium isotopics. The monthly composite will be analyzed for additional elemental

isotopics if they are suspected to be present in Banner Spring Branch effluents at levels exceeding 10% of the concentration values in Appendix B, Table 2, Column 2, 10 CFR Part 20. Martin Creek downstream samples are collected and analyzed for gross alpha and gross beta radioactivity. The action levels for Martin Creek are stated in Table 5.1.

5.1.2.2 Action Levels for Liquid Effluents

Prior to final discharge from the Waste Water Treatment Facility, a gross alpha and beta radioactivity analysis is performed to determine the acceptability for discharge. The batch concentrations allowed to be released without prior approval of the environmental protection function are the action levels stated in Table 5.1. Waste solutions in which the alpha or beta concentration exceeds one of these action levels will be discharged only after approval by the environmental protection function manager. If it is found that any discharges over a twelve month period caused the dose to members of the public (from Waste Water effluents) to exceed the administrative dose constraint of 10 mrem (which is 10% of the dose limit specified in 10 CFR 20, Section 1301), the NRC will be notified of the event in writing within 30 days.

The result of the insoluble radioactivity measurement performed on the Groundwater Treatment Facility monthly composite sample will be compared to the amount of insoluble radioactivity present in similarly processed background water samples. If insoluble radioactive materials are detected in process effluents at concentrations which are statistically greater than concentrations measured in background samples, Groundwater Treatment Facility discharges to the sanitary sewer will be stopped until appropriate corrective actions are effected to eliminate discharges of insoluble radioactivity.

Noncontact cooling water, sewer discharges, and other surface water effluents are monitored as indicated in Table 5.1. Samples of these effluents have action levels as stated in Table 5.1.

5.1.2.3 Reporting Methods

Alpha and beta activity releases in liquid effluents are summarized in an internal quarterly liquid effluent report. This report includes information on both alpha and beta activity emissions for each liquid effluent stream (i e., Waste Water Facility, Banner Spring Branch, Martin Creek, and Municipal Sewer).

Activity release data are accumulated and reported on a semiannual basis to the NRC as required by 10 CFR 70.59. A format similar to that presented in Regulatory Guide 4.16 is followed for this report. If semiannual average activity concentration for Waste Water Treatment Facility effluents exceed concentrations listed in Appendix B, Table 2, to 10 CFR Part 20, results of an assessment of the effective dose equivalent to the maximally exposed off-site receptor from these effluents will be included in this semiannual report to the NRC. The methods used to perform this assessment and additional action levels are discussed in Section 5.1.2.4.

5.2.7 Ground Water Monitoring

NFS will monitor groundwater to determine if the quality has been impacted downgradient of the NFS plant site.

Groundwater flow at the NFS site is to the north-northwest. Figure 5.2 depicts the water table surface for March 1998 and is representative of overall groundwater flow. To determine the impact of NFS operations on downgradient groundwater quality, one upgradient well (52) and ten downgradient wells (98A, 99A, 100A, 100B, 101A, 102A, 103A, 104A, 105A, 106A) will be monitored quarterly at a minimum for gross alpha and gross beta activity.

To determine potential releases from the two 6000-gallon underground tanks, NFS will monitor two wells (LD-1A, LD-2A) which are located immediately adjacent to the tanks, one upgradient well (70A), and one downgradient well (91). These wells will be sampled quarterly when the tanks are in use, and analyzed for gross alpha and beta activity at a minimum.

All groundwater analytical results will be reviewed and evaluated. If the gross alpha activity in a well exceeds 15 pCi/L, then at a minimum, isotopic analysis for uranium will be performed. For wells which exceed 15 pCi/L gross alpha, isotopic plutonium and/or isotopic thorium analysis will be performed when the well contains these contaminants at levels significantly greater than background, or if potential contamination in the area indicates isotopic plutonium and/or thorium analysis should be conducted. Wells which routinely exceed 15 pCi/L gross alpha and have no history for plutonium or thorium contamination will be sampled annually for plutonium and thorium to confirm their continued absence. If gross beta activity in any well exceeds 50 pCi/L then analysis for Tc-99 will be performed.

Monitoring well locations for the minimum program are depicted in Figure 5.3. Table 5-1 provides information on the sample type, collection frequency, analysis, action level and minimum detectable concentration.

6.5.2 Special Processing Unit in the Fuel Development Facility

The special type of finishing unit is limited to no more than [redacted] of uranium-235 per batch, and the boron concentration in the poisoned cooling solution must be at least four grams per liter. Refer to Chapter 15 of Part II for justification.

6.5.3 Carbon Dioxide Fire Suppression System in KAST Uranium Recovery Facility

A carbon dioxide (CO2) fire suppression system shall be maintained and operable in selected areas of the KAST Uranium Recovery Facility to mitigate the risk of criticality arising from a combustible liquid fire. Maintenance and testing of the suppression system shall be conducted in accordance with applicable portions of NFPA 12, "Standard on Carbon Dioxide Extinguishing Systems." In conjunction with the installation of this system, employee training on the associated emergency procedures and equipment shall be conducted to enhance the safety of personnel who may be working in the facility. Should the CO2 fire suppression system become inoperable, continued process operations involving combustible liquids within the solvent extraction area of the KAST Uranium Recovery Facility shall require instituting compensatory measures in accordance with requirements specified in the NFS procedure relating to impairments for fire protection equipment.

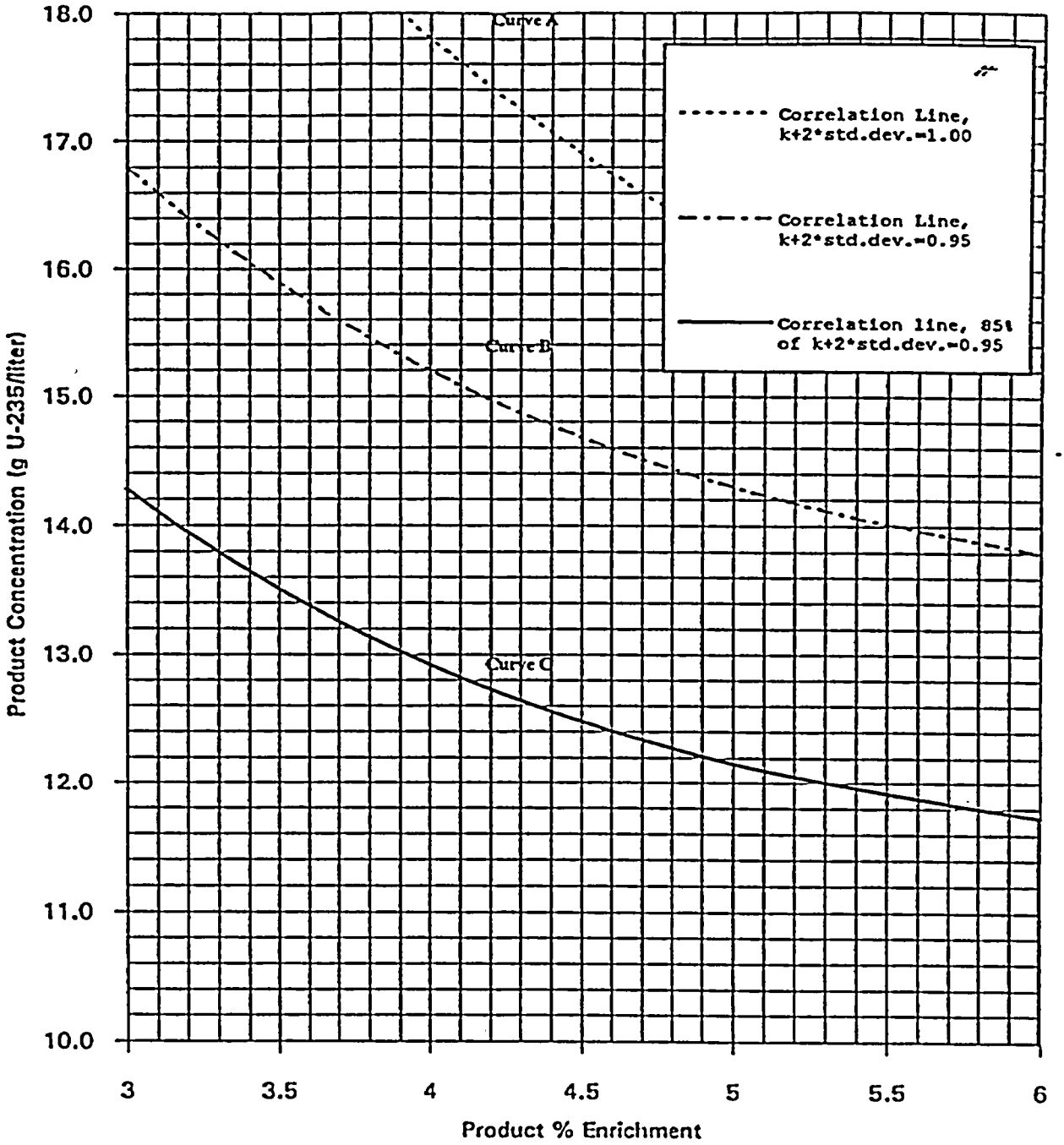
6.5.4 Enrichment Blending System

A system for performing the blending of a high-enriched UNH solution with a natural, depleted, or slightly enriched UNH solution to produce a low-enriched UNH solution may be operated. The blended product will be discharged into a large geometry vessel. Rather than using "dual analysis," the system will implement at least one in-line measurement of the ^{235}U concentration of the blended solution prior to discharge into the large geometry vessel.

The maximum enrichment measured shall be used throughout the rest of the system. Engineering and procedural controls shall be utilized to prevent the solution in the tank from exceeding the criticality control limit for $g^{235}U$/liter. The controls shall meet the double contingency principle as stated in Section 4.1.1. One element of control which will be utilized is that the only time solution can be transferred to the high-enriched feed columns is when the blend tank is empty. Refer to Chapter 15 of Part II for justification.

Limiting conditions shall be placed on certain parameters for the blending operation. These operational parameters are: grams uranium per liter for the two feed solutions; enrichment of the two feed materials; and volume of the two feed solutions.

Figure 6.1 - Curves for Defining Limiting Conditions of Operation for the Enrichment Blend



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CHAPTER 10

FACILITIES DESCRIPTION

A. SITE LAYOUT

10.1 SITE LAYOUT

The Nuclear Fuel Services (NFS) site is located in Erwin, Tennessee. The facilities within the site consist of numerous small buildings, the majority of which are within the Protected Area fencing. The administration buildings and guardhouses are glass/concrete structures and structures made of local brick; the process and process support buildings are predominantly constructed of precast concrete panels and white painted cement block. Metal "Butler-style" buildings are also used to house process support facilities such as respirator cleaning and testing, offices, decommissioning activities, and equipment and supplies storage.

Buildings within the plant have been designated with numbers and names as shown in Figure 10.1. Descriptions of the principal activities for each building are provided in the following Sections. Building layouts and more detailed process descriptions are included in Chapters 7 and 15.

10.1.1 Warehouse Facilities

Warehouse and material storage facilities include the Industrial Park Facility (IPF) Warehouse, Buildings 300, 310, southeast portion of 304, south and east sections of 306, 135, 133, 132, the south end of 233, and the UNB (Bldg. 510) located within the BLEU Complex. No unstable or radioactively contaminated chemicals are stored in these buildings such that release to the environs is probable.

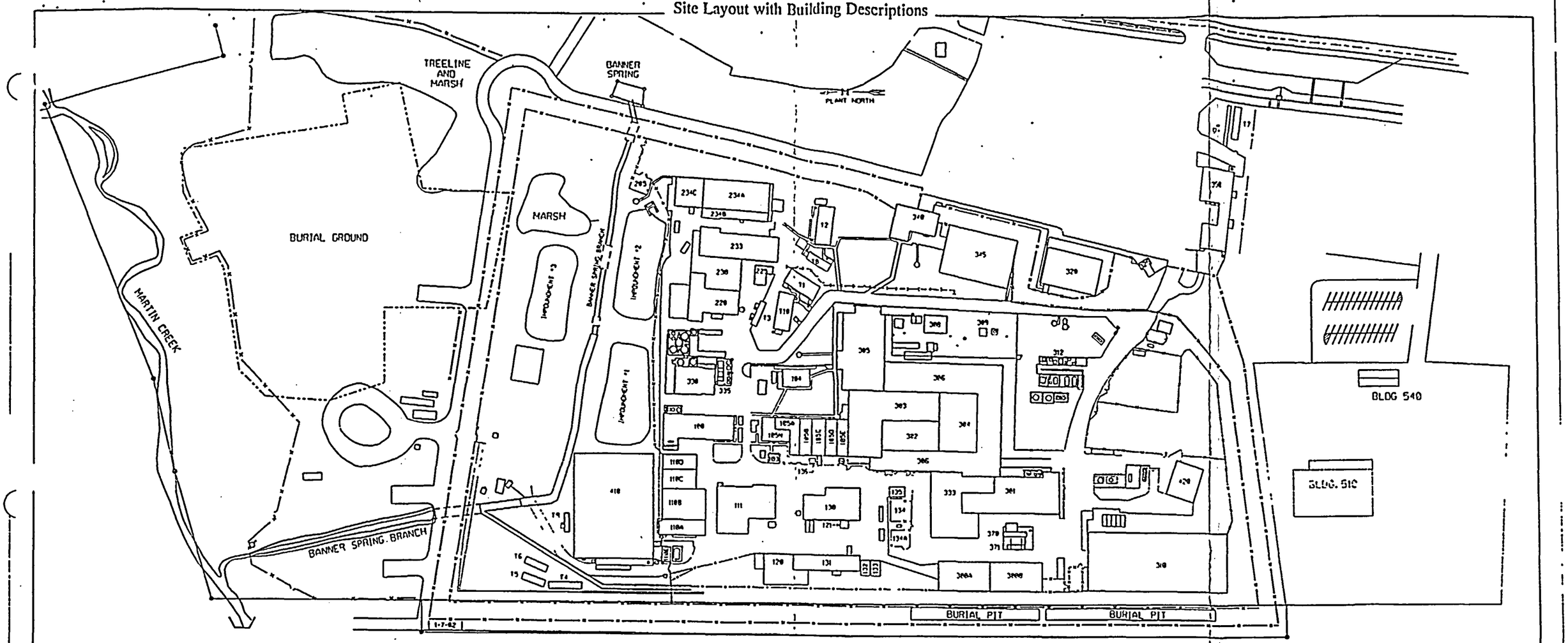
10.1.2 Maintenance Facilities

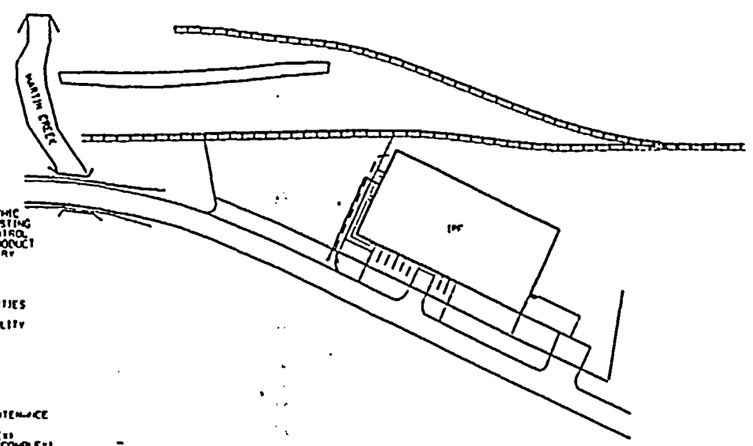
The maintenance facilities reside in Buildings 120, 121, and the east section of 306. The plant's main maintenance facility is in Buildings 120 and 121.

10.1.3 Materials Staging and Medical Facility

Building 350 is a multi-function facility which includes medical facilities (e.g., medical records, examining rooms, Fitness-for-Duty testing facility, and emergency decontamination), the in vivo counting facility, and the shipping/receiving staging area.

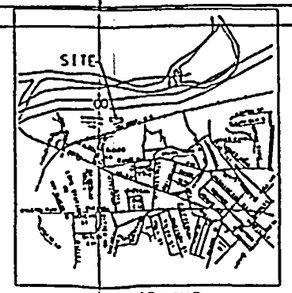
Figure 10.1
Site Layout with Building Descriptions





BLDG. NO.	NAME OR DESCRIPTION
230	SERVICE BUILDING AND
	NDA CALIBRATION/STANDARDS #1-#3
103	EMERGENCY RESPONSE FACILITY
104	RESPIRATOR FACILITY
105N	OFFICES
105A	CENTRAL LABORATORY - SPECTROCHEMIC
105B	CENTRAL LABORATORY - PHYSICAL TESTING
105C	CENTRAL LABORATORY - PROCESS CONTROL
105D	CENTRAL LABORATORY - STACK-TO PRODUCT
105E	CENTRAL LABORATORY - WET CHEMISTRY
1100/1108	DEVELOPMENT LABORATORY
1100	DEVELOPMENT LABORATORY
1100	DEVELOPMENT LABORATORY
1100	YARD STORAGE
111	LEU RECOVERY FACILITY/PLANT UTILITIES
120	CENTRAL MAINTENANCE SHOP
121	MAINTENANCE DEPARTMENT PUMP FACILITY
130	PLANT UTILITIES
131	DEVELOPMENT LABORATORY
132	STORAGE
133	STORAGE
134/134A	POWER SUB STA. #1
135	STORAGE
136	YARD STORAGE
205	POWER SUB STA. #2
220	200 COMPLEX SERVICE BUILDING/MAINTENANCE
223	200 COMPLEX FAN BUILDING
230	NEU RECOVERY FACILITY (200 COMPLEX)
233	NEU RECOVERY FACILITY/VAULT (200 COMPLEX)
234A	INACTIVE
234B	INACTIVE

BLDG. NO	NAME OR DESCRIPTION
234C	DECON & VOLUME REDUCTION FACILITY
300A	GENERAL WAREHOUSE
300B	GENERAL WAREHOUSE
301	PRODUCTION FUEL DEVELOPMENT (300 COMPLEX)
302	PRODUCTION FUEL MANUFACTURING/INCINERATOR (300 COMPLEX)
303	PRODUCTION FUEL MANUFACTURING (300 COMPLEX)
304	WAREHOUSE/DECONTAMINATION/MIXED WASTE TREATMENT (300 COMPLEX)
305	OFFICES BUILDING
305E	MECH.EQUIP/SCRUBBER/STORAGE/MAINTENANCE (300 COMPLEX)
305S	VAULT (300 COMPLEX)
305W	NDA SCANNING/NEU SHIPPING & RECEIVING/EMERGENCY GENERATOR (300 COMPLEX)
306	300 COMPLEX FAN BUILDING
307	STACK SAMPLING BUILDING (300 COMPLEX)
310	WAREHOUSE
312	BULK CHEMICAL FACILITY
320	ADMINISTRATION BLDG
325	GUARDHOUSE VEHICLE ENTRY/EXIT
330	WASTE WATER TREATMENT FACILITY
333	BLEU PRODUCTION FACILITY
335	GROUNDWATER TREATMENT FACILITY
340	GUARD HOUSE PERSONNEL ENTRY/EXIT
345	OFFICE BUILDING
350	MATERIAL STAGING/MEDICAL FACILITY
370	VAGAS NDA FACILITY
371	VAGAS NDA FACILITY MOBILE ENCLOSURE
410	POND 4 CONTAINMENT FACILITY
420	MOTOR POOL FACILITY
510	BLEU URANYL NITRATE BLDG.
540	BLEU SECURITY BLDG.
T-1	PROCESS ENGINEERING OFFICE TRAILER
T-2	DECOMMISSIONING OFFICE TRAILER
T-3	DECOMMISSIONING SAMPLE TRAILER
T-4	DECOMMISSIONING BREAK/OFFICE TRAILER
T-5	DECOMMISSIONING MENS CHANGE TRAILER
T-6	DECOMMISSIONING WOMENS CHANGE TRAILER
T-7	LAUREN OFFICE TRAILER
T-8	DECOMMISSIONING CHANGE TRAILER
T-9	DECOMMISSIONING SUPERVISORS TRAILER
T-10	DECOMMISSIONING OFFICE TRAILER



VICINITY MAP

BY	DATE	REVISION	LET
		ORIGINAL ISSUE	—

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TOLERANCE UNLESS SPECIFIED: FRACTIONS ± 1/16"; ANGULAR ± 1/2°; DECIMAL .XX ±.01, .XXX ±.005

NUCLEAR FUEL SERVICES, INC.
ERWIN, TENNESSEE

PLANT LAYOUT WITH INDUSTRIAL PARK FACILITY WAREHOUSE AND PROPOSED BLEU COMPLEX

DRAWN BY: MC NEWBLEY; SCALE 1"=100'-0"; DATE 2-26-82

DRAWING NO. 005-C0192-D2

CONFIGURATION CONTROL YES ____ NO ____

10.1.4 Highly Enriched Uranium Recovery Facility (Inoperative)(HEURF)

The HEURF is comprised of four buildings referred to collectively as the 200 Complex. The four buildings that comprise the 200 Complex are: 220 (low-bay area) which contains change rooms and offices,; 225 which contains the process ventilation fans; 230 which was the production area; and 233 which also was a production area and a vault-type storage area. The vault area remains active with the remainder of the facility undergoing decommissioning.

10.1.5 Service Building and NDA Laboratory

Building 100 contains change rooms, lunch rooms, First-Aid Station, office area, vending food storage, decontamination laundry facility, and NDA laboratory.

10.1.6 Research and Development Laboratories

The Research and Development (R&D) Laboratories are located in Buildings 105, 110 and 131. These buildings contain facilities for conducting engineering studies and process evaluations for environmental remediation projects and for new business opportunities for NFS. These studies and evaluations may involve separating hazardous material and radioactive material, recovering resources from hazardous and/or radioactive waste, and treating hazardous and/or radioactive waste material. They may also involve R&D of chemical and radioactive material processing and manufacturing technology in support of new business development. These laboratories also conduct laboratory analyses in support of the engineering studies, as well as for customer and NFS process or waste materials. These activities are also licensed by the State of Tennessee.

10.1.7 Respirator Facility

Building 104 houses the respirator facility which includes a respirator laundry; an inspection, testing, and quality assurance area; a fit-test facility; and offices for individuals involved in these activities.

10.1.8 Low Enriched Uranium Recovery Facility (LEURF)

In the past, the LEURF was located in Building 111. The process equipment has been removed but the process described in Chapter 15 could be installed again should NFS obtain a need for this type of service. This building is also the location for natural and depleted uranium processing under NFS' State of Tennessee license. The current principal activities for this building are to prepare and stage containers of low level radioactive waste (LLW) generated by ongoing plant

decommissioning activities, prior to shipping to a disposal facility, and storage of uranium solutions.

10.1.9 Administration Buildings

Buildings 105, 130 (east annex), 120 (north end), 305, 320 and 345 house offices and computer facilities. Buildings 325 and 340 are the main security check points for vehicles and persons entering and leaving the site's Protected Area.

10.1.10 Central Analytical Laboratory

Building 105 and the northwest portion of Building 303 contain the plant's Central Analytical Laboratory. This laboratory handles samples from all plant processing facilities (HEU, LEU, natural U, and depleted U), scrap recovery facilities, waste water treatment facilities, and select environmental monitoring programs.

10.1.11 Plant Utilities

Building 130 houses non-radioactive plant utility services. This building contained uranium processes in the past, and covered fixed radioactive contamination exists. The utilities located in this building are compressed air, deionized water, and steam.

10.1.12 Production Facility

This facility is comprised of eight buildings, which make up the majority of the 300 Complex. Building 333 currently houses uninstalled process equipment. This building is the planned location for future new business involving downblending of enriched uranium.. Building 301 contains a development process for producing classified products that contain highly enriched uranium. Buildings 302, 303, 304, and 306 contain unit operations which produce a classified product containing highly enriched uranium. Building 303 also contains offices, change rooms, a security alarm station, and a portion of the Central Analytical Lab. Building 304 contains process support equipment, non-radioactive chemical process storage tanks, offices, non-nuclear stores warehouse, and a mixed waste treatment process. Building 306 contains process support equipment, process ventilation scrubbing equipment, vault-type storage area, shipping and receiving area, and equipment maintenance area. Building 308 contains the process ventilation fans for this facility. Building 309 contains the gaseous effluent sampling equipment for the main plant stack. The processes in these buildings are more fully described in Chapter 15 (classified section).

10.1.13 Pond 4 Containment Building

Building 410 provides weather protection for remediation of portions of a former on-site disposal area designated as Pond 4. The Pond 4 disposal area also extends to areas outside of the Building 410. This facility is also licensed by the State of Tennessee for handling waste, soil, and debris contaminated with source materials.

10.1.14 Waste Water Treatment Facility

Waste water treatment is conducted in Buildings 330 and 335. Building 330 contains the process for treating liquid effluents generated by the process facilities, R&D laboratories, laundry, decommissioning activities, and analytical laboratory. The effluents are treated to meet the requirements of a National Pollutant Discharge Elimination System permit issued to NFS by the State of Tennessee and 10 CFR Part 20. Treated effluent is discharged to the Nolichucky River. Building 335 processes groundwater from the site. The groundwater is treated to meet the requirements of a pretreatment permit issued to NFS by the Erwin Publicly Owned Treatment Works (POTW) and 10 CFR Part 20. Treated groundwater is discharged to the Erwin POTW.

10.1.15 Motor Pool

Building 420 is for storage and maintenance of large earth-moving equipment.

10.1.16 Uranyl Nitrate Building (Bldg. 510)

Uranyl Nitrate liquid is stored in Building 510. This building contains 24 storage tanks with a capacity of approximately [redacted] Support facilities for unloading the Uranyl Nitrate liquid containers are part of the building. Liquid will be stored until required by the Oxide Conversion Building (OCB) (Bldg. 520) process (future amendment).

Guard/Security Building (GSB) (Bldg. 540) contains no radiological controlled material and is strictly a support facility.

10.1.17 BLEU Preparation Facility (Bldg. 333)

The BLEU Preparation Facility (BPF) houses the processes to convert HEU materials to pure HE uranyl nitrate solution, a process to prepare blendstock (N uranyl nitrate solution), and a process to mix the HE uranyl nitrate and blendstock solution to form a LE uranyl nitrate solution (product). The LE uranyl nitrate solution will be transferred to the Uranyl Nitrate Building after verification that the

solution meets the product specifications.

CHAPTER 10

C. VENTILATION - H VAC

10.3 VENTILATION SYSTEMS

10.3.1 General

The ventilation systems can be functionally separated into two categories: the heating, ventilation, and air conditioning (HVAC) system and the process exhaust ventilation system (PEVS). A description of these systems in facilities wherein uranium is handled and a discussion of PEVS safety are included in this section.

The heating, ventilation, and air conditioning systems are designed and operated during processing to maintain a clean and conditioned air supply to all areas of the Plant and to exhaust air through appropriate filters or washing devices from equipment and areas where significant quantities of radioactive materials are handled. Under normal and most anticipated abnormal process conditions, personnel will not require respiratory protection equipment.

The PEVS provides air flow from areas of lesser potential contamination to areas of higher potential contamination, confines and contains air streams containing radioactive constituents, and minimizes potential accumulation of contamination within the air handling duct work.

Interior ductwork for the ventilation systems is constructed of non-combustible and limited-combustible materials, depending on the application. Non-combustible ductwork is used in elevated off-gas temperature applications to allow effluent temperatures to cool prior to entering limited-combustible ductwork. Where ductwork penetrates fire walls, fire-stop devices are used to control the potential for fire spread. Dampers are provided for non-combustible ducts. Dampers or self-sealing restricting collars are used for PVC ducts as required by applicable codes. Most of the exterior ductwork is constructed of fire-retardant fiberglass reinforced plastic (FRP) with a class I rating (flame spread rating of 25 or less). The rest of the exterior ductwork is constructed of non-combustible and limited-combustible materials.

10.3.2 Heating, Ventilation, and Air Conditioning Systems

Each of the separate area HVAC air handling units appropriately combine fans, dampers, ducts, filters, signals and pneumatic and electrical control devices to provide heating and cooling consistent with the specific requirements of that area.

Information on the various HVAC systems is set forth below. All rates, where specified, are nominal.

- Roof-mounted air handling units recycle and filter the inside room air. The room air is cleaned by 30 percent efficient ASHRAE pre-filters followed by 85 percent efficient ASHRAE filters. The filtered air is heated or cooled as appropriate for personnel comfort before being diffused into the building.

- 200 Complex

Building	Process Exhaust (CFM)	HVAC Recirculation (CFM)
220	0	4,100
230	4,500	0
233	4,600	63,600
233 Vault	0	8,400

The total volume of air recirculated by the 200 complex HVAC system is 76,100 CFM. Room air in the amount of 9100 CFM is drawn into the PEVS and is replaced by fresh air entering the building.

- 300 Complex

Building	Process Exhaust (CFM)	HVAC Recirculation (CFM)
302	9,400	70,000
303	1,000	75,000
304	2,100	11,500
306-E	1,500	50,700
306-W	4,700*	15,000
306-S (Vault)	0	7,400
Incinerator	2,200	19,000
333	27,000**	61,300

*Includes 1,400 CFM for Room Air Exhaust Unit
** Includes 21,000 CFM for Room Air Exhaust Unit

The total amount of air recirculated by the 300 complex HVAC system is 248,600 CFM. Room air in the amount of 24,000 CFM is drawn into the PEVS and is replaced by fresh air entering the building.

- Vaults (both 200 and 300 Complexes)

The vaults have no process (PEVS) intakes, thus their HVAC systems supply recirculated air. Air flows from the vaults to adjacent process areas where air is drawn into the PEVS.

- BLEU Complex

Building 510 has an air handling unit located in the mechanical equipment room. This unit recycles and filters controlled area room air. The room air is filtered. This filtered air is cooled or heated as appropriate and delivered throughout the controlled area.

Building	Process Exhaust (cfm)	HVAC Recirc (cfm)
510	2000	9000

- Building 111

Building 111 has no process exhaust system. Heating for comfort is provided by either gas or steam heaters.

10.3.3 Process Exhaust Ventilation Systems

10.3.3.1 Highly Enriched Uranium Recovery Facility

The Highly Enriched Uranium Recovery Facility is in the process of being decommissioned. Equipment for the UF_6 Cylinder Cleaning process and the Downblending process has been removed. The PEVS components that were not needed to support the decommissioning activities have been disassembled and removed, in whole or in part. These PEVS components include: the demisting column for the UF_6 Cylinder Cleaning, the LEU conversion furnace off-gas Treatment System, the NO_x Process Scrubber, and the Building 233 Calciner Off-gas Treatment System. The removed PEVS components would be restored as described below or redesigned prior to new processing activities.

10.3.3.1.1 Calciner Off-Gas Treatment System

Gases are exhausted from the calciner and the conversion cleanup furnace to the PEVS and are treated serially by an afterburner to complete combustion, a cyclone separator to remove particulate, and a cooling duct section or an optional heat exchanger to cool the gases. These components are shown in sequence in Figure 10.3.

Gaseous effluents from the calciner and conversion furnace enter the afterburner at approximately 1200 °F. The effluent is directed into the afterburner flame to aid in oxidizing unburned gases and particulates.

The afterburner is a refractory-lined ductwork section with an 8", schedule 10 (nominal 8.3" inside diameter) pipe inlet. The afterburner outer shell is made of 16", schedule 10 (nominal 15.6" inside diameter) pipe with refractory lining with a 10.4" inside diameter. The ductwork between the afterburner and the cyclone separator is 10", schedule 10 pipe (nominal 10.4" inside diameter). The ductwork between the cyclone separator and the mixing tee is 8" schedule 10 pipe.

The cyclone separator is depicted in Figure 10.4. The cyclone section is designed to remove ash and allow it to fall into a safe diameter pipe and collection bottle.

The cyclone separator includes an integral reservoir and cooling section to hold collected ash within a safe diameter pipe prior to removal. The reservoir is a safe geometry vertical glass section with capacity to receive ash for approximately five to ten days of operation, depending on the materials introduced to the calciner. The cooling section is fitted with metal radiating fins for heat removal. A 4-foot-8-inch-long section near the cyclone section is insulated to protect personnel against heat.

An optional heat exchanger may be used to cool the process exhaust gas downstream of the cyclone separator before it enters the main scrubbers and to reheat it afterward, before it enters particulate filters. Its purpose is to prevent condensation from forming on the optional particulate filters immediately downstream while conserving heat energy. As indicated in Figure 10.3, the hotter upstream gas is routed through the tubes, while the gas downstream passes through the shell.

10.3.3.1.1.1 Nuclear Safety

- Afterburner: The nominal inside diameter of the afterburner is 10.4-inches and the maximum credible uranium concentration 40 gms U/liter (as dry ash); therefore, it is a safe, fully reflected geometry. Also there is no significant source of moisture available to moderate and compact the ash:

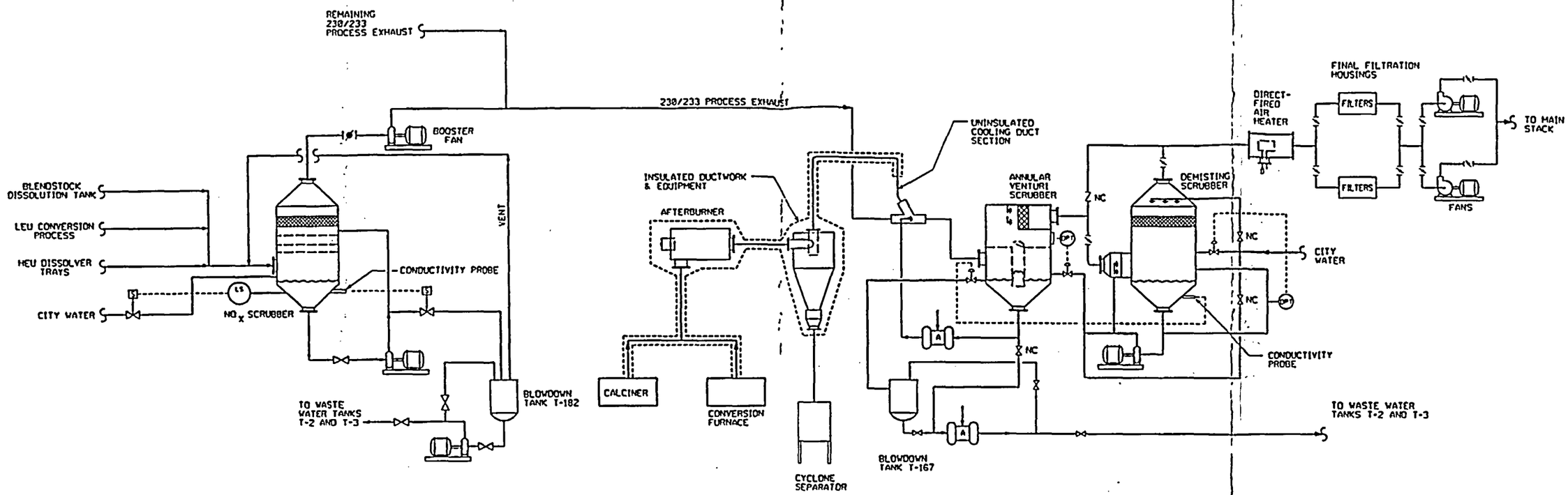
  a) no water or overflow line connected to the duct work upstream or downstream (i.e., between the calciners and conversion furnace and the venturi scrubber),

  b) during operation the air exhausted from the conversion furnace and calciners is at a temperature above the boiling point of water (typically 400°F to 800°F), and

  c) water vapor in the exhaust air is that in ambient air plus that from combustion or evaporation from coke.

  During normal operation the air flow is approximately 2800 LFM and is turbulent, therefore no significant settling of uranium bearing particulates is credible. Therefore, the afterburner and its exit duct meet double contingency.

Figure 10.3
Process Exhaust Ventilation Treatment System, Schematic, 200 Complex



BY	DATE	REVISION	LET
		ADDED HATCHING TO MIST ELIMINATOR	B
DKT	6-26-98	ADDED NOx SCRUBBER	A
DKT	06-10-96	ORIGINAL ISSUE	—

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TOLERANCE UNLESS SPECIFIED
FRACTIONAL ± 1/64"
ANGULAR ± 1/2°
DECIMAL .X ± .01 .XX ± .005 .XXX ± .001

REVIEWED BY
PROPOSED COMPLETION DATE:
DRAFTER
PROPOSED APPROVALS
REQ.

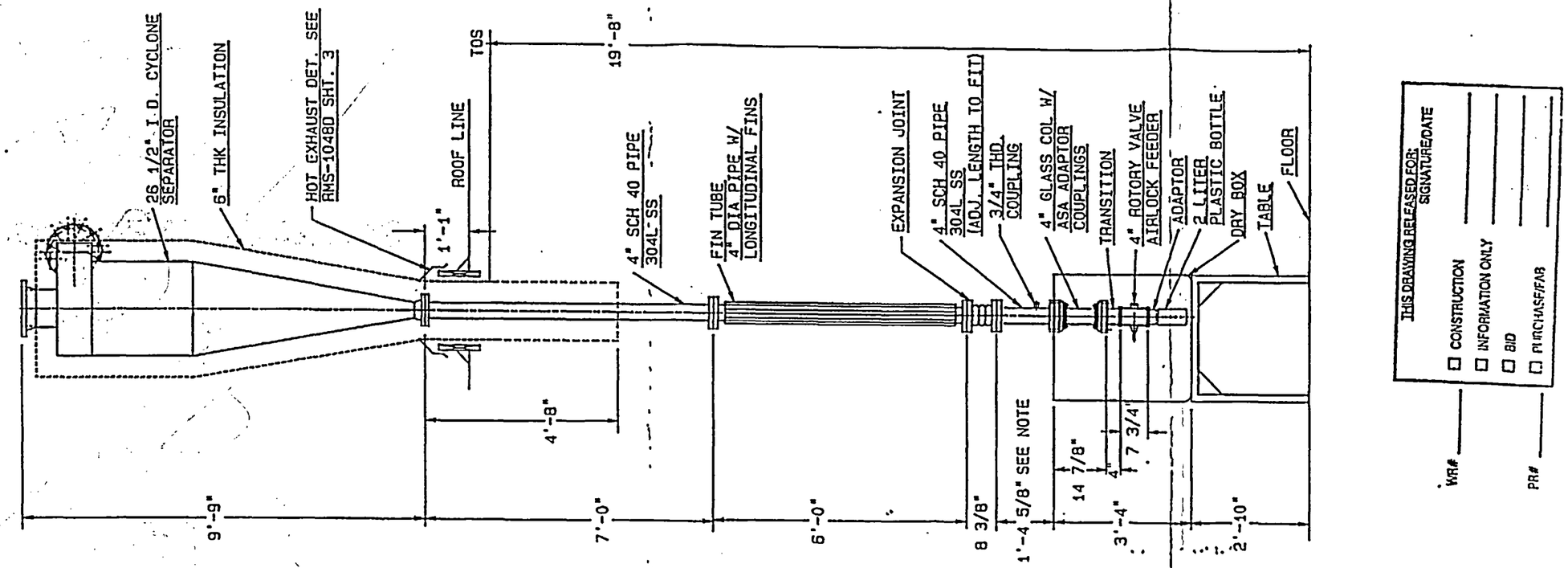
NUCLEAR FUEL SERVICES, INC.
ERWIN, TENNESSEE

PROCESS EXHAUST VENTILATION TREATMENT SYSTEM SCHEMATIC 200 COMPLEX

DRAFTER T.E. BLEVINS
AS-BUILT APPROVALS
REQ.
OWNER

SCALE NONE
DATE 7-17-98
DRAWING NO. 012-F0030-0
CONFIGURATION CONTROL YES ____ NO X

Figure 10.4
CALCINER CYCLONE SEPARATOR



BY	DATE	REVISION	LET
S.D.	8-12-87	CHANGED TO "B" SIZE	D
R.P.S.	8-5-87	ADDED FOOTER	C
S.D.	6-5-85	GENERAL REVISIONS	B
S.D.	5-28-85	ADDED EXPANSION JOINT & CHANGED RELATED DIM'S	A

R.C. Stout 10-19-90

NUCLEAR FUEL SERVICES, INC.
ERWIN, TENNESSEE

NAME
CALCINER CYCLONE ELEVATION

MADE BY STAN DAVIS
TRACED BY DB
CHECKED BY
APPROVED BY

SCALE NONE
DATE 4-3-85
DRAWING NO. RMS-1043B

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- Cyclone separator: The most restrictive possible fissile material characteristics in the cyclone separator are the same as for material charged to the calciner or conversion furnaces. In that case, 100% ^{235}U enriched uranium oxide with density not exceed six grams uranium per cubic centimeter (the maximum density observed) is assumed in the ash reservoir, cooling section and ash removal bottle. The nuclear safety of these components is assured by geometry.

  The nuclear safety of the cyclone section is assured by administrative and operational controls, that prevent accumulation of materials therein.

  The cyclone separator is designed for ash to fall into the safe diameter pipe at the bottom of the cyclone and not collect in the cyclone section itself. The cooling section plus ash reservoir could hold about a 120-day ash accumulation, and the [redacted] ash collection bottle operating period is about eight days when ash generation is in process. Through administrative controls requiring the inspection and change-out of the [redacted] collection bottle on a specified period, overfilling of the four-inch-diameter pipe and collection of ash within the cyclone section are prevented.

  Per procedure each bottle of ash is weighed after removal from the cyclone separator. Operating experience with the cyclone separator indicates that a [redacted] of the ash will typically weigh less than [redacted] and contains less than [redacted] ^{235}U. A [redacted] container of UO_2 enriched to 100 percent ^{235}U is a safe volume at about 0.33 of the minimum critical volume when fully reflected by water as long as the uranium density does not exceed [redacted] The minimum critical volume, [redacted] of UO_2/H_2O mixture fully reflected by water, occurs at both 0.55 and [redacted]. Therefore, under the most restrictive conditions, the ash can be safely removed from the cyclone separator in a [redacted] bottle.

  The ash reservoir and cooling sections of the system are nuclearly safe at 0.77 of the fully reflected minimum critical diameter for 100 percent ^{235}U up to a density of [redacted] in a UO_2-H_2O mixture. A four-inch glass section is installed near the ash reservoir to permit visual inspection of collected ash.

  In the event of failure of these controls, critical conditions will not occur. The observed uranium density has typically been less than [redacted] U/cm^3

solids collected by the cyclone separator. It has been demonstrated that, with an H/U ratio of greater than 50, approximately [redacted] of ^{235}U in a volume of about [redacted] is required to achieve critical conditions. Such an accumulation would require several months of furnace operation with no ash removal from the cyclone separator. Thus, long-term failure to follow operating procedures would be required for enough uranium to accumulate in the cyclone section for critical conditions to occur.

Moderation control for the cyclone separator is provided by the temperature of the air exhausted from the calciner, conversion cleanup furnace, and afterburner operations. No credible upset condition has been identified that could result in moderation levels approaching the calculated critical H/U of greater than 50.

- Heat exchanger (optional): Observed accumulation of uranium in the heat exchanger has been very low. After several months of use, [redacted] ^{235}U was estimated by quantitative gamma measurement (NDA) to be in the heat exchanger tubes, although solids cleaned out of it contained only abou[redacted] ^{235}U. The ^{235}U in the solids removed averaged less than [redacted] and less than [redacted]. This was a nuclearly safe concentration and a safe mass, even if it had been wet. Yet the calciner and/or afterburner heat can be expected to prevent water from condensing in the heat exchanger.

- Surveillance: By routine quantitative gamma surveys for uranium accumulation and action to remove it if an action limit should be reached, nuclear safety is assured. Quantitative gamma radiation surveys of the cyclone section and of the heat exchanger are performed weekly during calciner operation to monitor any gradual accumulation of uranium-bearing solids. In the event as much as [redacted] ^{235}U accumulates in either component, calcining and material conversion are discontinued until the component has been cleaned out.

10.3.3.1.1.2 Fire Safety

- Afterburner: The PEVS incorporates several controls to provide afterburner safety. Automatic controls prevent the main gas valve from opening until the pilot is lighted. A temperature sensor downstream enables monitoring and control of the operating temperature. Either an electric eye flame detector, a differential pressure measurement to sense loss of inlet air, or an over- temperature sensor downstream of the burner will shut the main gas valve and turn off the burner upon actuation. To

prevent overheating equipment downstream, controls are installed to shut off the afterburner in the event the fan downstream turns off, air entering the annular venturi scrubber exceeds the temperature set point, or air exiting the air heater exceeds the temperature set point.

The afterburner ductwork fire safety is discussed in Section 10.3.3.1.2.2.

10.3.3.1.2 PEVS Scrubber System

The 200 Complex process exhaust ventilation system (PEVS) includes an annular venturi scrubber with a mist eliminator as depicted in Figure 10.3. A controlled bleed stream of scrubber water is let down into a blowdown tank. When it is nearly full, the water is pumped into a waste collection tank for volume measurement and sampling for uranium concentration analysis. Afterward, it typically is discharged to the WWTF.

The annular venturi scrubber uses a venturi tube (with an annular opening) positioned inside the scrubber tank. The scrubbing action is achieved by automatically controlling the water level at the base of the venturi tube. Make-up water is normally let down from the demisting scrubber. A scrubber water pH sensor and controller controls caustic soda solution addition to the scrubber water to maintain a nominal pH of 9-11 by controlling caustic pump operation.

A demisting scrubber is installed in the PEVS downstream of the annular venturi scrubber for use as an alternate to downstream particulate filtration. Diagrammed in Figure 10.3, it provides additional air cleaning by spraying recirculating water onto a chevron-shaped lattice through which the air passes. Afterward, the air flows through a mesh demister pad before leaving the vessel.

A scrubber water conductivity sensor and controller operates (opens) the blowdown control valve on the annular venturi scrubber to limit solids accumulation in the demisting scrubber water. In the event the demisting scrubber water conductivity exceeds the setpoint, the controller opens the venturi scrubber blowdown control valve, allowing water to drain from the venturi scrubber tank and be replaced by water from the demisting scrubber tank. In turn, the conductivity of the water in the demisting scrubber is reduced automatically by the makeup water added to the demisting scrubber. The demisting scrubber conductivity controller activates a light on the controller and on the annunciation panel and sounds a buzzer whenever the alarm set point is exceeded.

10.3.3.1.2.1 Nuclear Safety

The uranium concentration of the scrubber water and the possible accumulation of uranium-bearing solids in the scrubbers and blowdown tank during processing operations are monitored by the following methods:

- blowdown water is sampled daily in the blowdown tank or the waste collection tank, is analyzed for uranium, and the results reported within four hours after the start of the next operating shift.

- the scrubbers and blowdown tank are surveyed weekly by quantitative gamma measurement (NDA) for uranium accumulation;

- the interior of the venturi scrubber is inspected visually twice a year;

- the venturi scrubber inlet air duct up to the building roof is surveyed weekly by NDA and is also flushed with water that is continuously recirculated from the scrubber vessel and drains back into it; and

- the three most suspect points for possible accumulation in the calciner ventilation duct above the roof and connected to the scrubbers are surveyed weekly by NDA.

This surveillance is performed whenever SNM is actively being processed in the facility or when maintenance activities involving SNM-processing or ventilation equipment are being performed. All NDA and sampling activities, as well as all laboratory analyses, are performed in accordance with written and approved procedures, and personnel performing these activities are trained and formally qualified for this work. The sampling, NDA, and laboratory methods can accurately detect the action levels specified for this scrubber system. All NDA and laboratory equipment are calibrated with certified standards in accordance with approved procedures. In addition, annual auditing ensures that these activities are conducted per the procedures.

Uranium accumulation is kept within safe bounds in the 200 Complex PEVS by removing any excess observed during surveillance. If more than [redacted] ^{235}U is found accumulated in either scrubber, in the scrubber water blowdown tank, or localized in the PEVS duct, the excess uranium inventory is removed to less than the action limit. If more than a safe wet mass, [redacted] ^{235}U, is measured in these pieces of equipment, operations will be halted; and the affected equipment will be taken out of service and cleaned to less than the limit.

Additional features of the PEVS that contribute to the safe operation of the system are as follows:

- Uranium-containing tanks and columns that are vented to the PEVS either are able to overflow from the vessel or have a siphon break installed in the line to the PEVS. In the event liquid were to overfill one of these vessels, it would drain onto the floor and would not be drawn into the PEVS.

- Except for the calciner and conversion cleanup furnace, gloveboxes in which dry, dispersible, uranium-bearing material is processed have exhaust ventilation equipped with HEPA filtration near the juncture of the glovebox and the PEVS duct. These filters preclude significant material entry into the PEVS ductwork from such processes.

- The venturi scrubber blowdown tank has a recirculation pump to keep the water mixed and prevent solids from settling.

10.3.3.1.2.2 Fire Safety

- Process Furnace Ductwork: Electrically heated process furnace operations are equipped with over-temperature controllers and thermocouples independent of the process temperature controller measuring the furnace temperature.

  The conversion process off-gas passes through a HEPA filter and then is cooled in an un-insulated section of stainless steel duct prior to connection with the PVC duct inside the 233 Head-End Room. The PVC duct isolates the noncombustible ductwork for the heat source from the scrubbers and other FRP components. The conversion furnace off-gases merge with the main 233 Head-End Room ambient temperature air streams. This provides additional cooling due to mixing of the gases.

  The off-gases from the Calciners and Conversion Furnace pass through noncombustible duct with exterior insulation and are combined prior to entering the afterburner. The afterburner is an insulated refractory-lined high temperature alloy duct equipped with a direct fired burner. The afterburner gases pass through a Cyclone Separator before entering an un-insulated duct section used to reduce the temperature of the stream prior to entering the stainless steel Mixing Tee. The ductwork downstream of the afterburner, the Cyclone Separator and the Mixing Tee are made of noncombustible materials with exterior insulation except for the cooling

section prior to the Mixing Tee. The afterburner controls are discussed in section 10.3.3.1.1.2.

- Scrubber Systems: The 200 Complex process off-gases pass through the Mixing Tee prior to entering the Scrubber Inlet Duct. At the Mixing Tee, ambient temperature off-gas streams merge with the high temperature off-gases from the afterburner. The afterburner off-gas merge with the main 230/233 ambient temperature air streams which provides significant cooling as the air masses mix. A duct wash spray (primarily for preventing material build-up in the S-shaped Scrubber Inlet Duct) also provides some cooling of the off-gases. The duct wash spray recirculates water from the Venturi scrubber tank.

  The inlet duct to the Venturi scrubber is equipped with a high Scrubber Inlet Duct temperature controller and thermocouple. A high Scrubber Inlet Duct temperature alarm or a thermocouple failure will shut down the afterburner. The scrubber inlet duct high temperature alarm is annunciated visually and audibly inside the 230 Building and outside in the scrubber area at annunciator panels.

- Air Heater: The Air Heater is a direct-fired burner installed in a non-combustible duct section. The Air Heater incorporates several controls to ensure combustion in the unit occurs safely. Automatic controls prevent the main gas valve from opening until the pilot is lighted and ensure the fuel gas flow is shutdown if the flame in the burner is lost. The main fuel gas supply is isolated by a fuel blocking valve to ensure that fuel does not enter the system when the Air Heater is off.

  The Air Heater operating temperature is regulated by a temperature controller connected to inlet and outlet thermocouples to control the temperature rise across the Air Heater. An independent high duct temperature controller with an independent thermocouple monitors the outlet temperature of the Air Heater to prevent overheating. If the high duct temperature alarm is activated, a flame detector fails, or a thermocouple fails the Air Heater will shut down. The Air Heater Shutdown alarm is annunciated visually and audibly inside the 230 Building and in the scrubber area at annunciator panels.

  A duct vacuum switch monitoring the vacuum at the inlet of the ventilation exhaust fans will also shut down the Air Heater if a low air flow condition exists. The duct vacuum switch will also shut down the Afterburner and

activate the "Loss-Of-Ventilation" alarms which have a separate audible alarm located in three locations inside the 230/233 Buildings.

- Off-Gas Filters: Off-gas filters conform with industry standards for HEPA filters and for prefilters, such as Underwriters Laboratories Standard UL-586 and/or UL-900.

10.3.3.1.3 **PEVS Particulate Filtration System**

Particulate filter housings are installed in parallel downstream of the scrubber system for optional use when needed to meet radioactive effluent limits. An air heater and an optional heat recovery heat exchanger minimize or prevent moisture condensation on the filters. Either or both may be used to raise the air temperature above the dew point when the filters are in service.

Two fans are installed in parallel downstream of the filter housings. One fan is normally operated for the 200 Complex PEVS operation, and one fan is a spare.

10.3.3.1.3.1 **Safety**

Automatic controls guard against overheating air reaching the particulate filters. A high duct temperature controller shuts off the air heater if the over-temperature set point is reached. If both exhaust fans are to shut down, a duct vacuum (prior to the fans) controller shuts off the air heater and the afterburner.

10.3.3.1.4 **Special Process Ventilation - Building 230**

10.3.3.1.4.1 **UF_6 Cylinder Cleaning Process Off-Gas**

The process exhaust ventilation includes the venting of the glovebox for the UF_6 Cylinder Wash process (station 1) and the venting of the Wash Solution Receiving Columns (stations 5A and 5B) and the Wash Solution Storage/Measurement Columns (stations 5C and 5D). Off-gases from the UF_6 Cylinder Wash glovebox (station 1) are routinely dry and are vented to a separate ventilation duct branch. Off-gases from the Receiving Columns (5A and 5B) are routinely wet containing steam and moisture droplets which are vented to the Demisting Column (station 6). The off-gases from the Demisting Column are combined with the off-gases from the Storage Columns (5C and 5D) and vented to the main process ventilation ductwork for the 230 Building through a siphon break to prevent any wash solution from entering the ventilation ductwork.

10.3.3.1.4.1.1

Nuclear Safety

The off-gas vent system (demisting column) is designed to remove uranium from the gas stream prior to entering the ductwork leading to the PEVS. The gas stream will only consist of steam and moisture droplets resulting from the injection of water into cylinders containing minimal quantities of UF_6. Steam and moisture droplets are de-entrained in the demisting section, in the top of a favorable geometry demisting column, and drop out to the bottom of the column for subsequent removal. A siphon break is maintained on the vent side to prevent any wash solution from entering the ventilation ductwork.

10.3.3.1.4.1.2

Fire Safety

The duct connected directly to the furnace is equipped with mesh filters in the upper section of the duct. The off-gases from the Receiving Columns are hard piped to the underside of the mist eliminator pad. The off-gases expand as they enter into the duct and then turn 180 degrees before exiting through the mesh filters, eliminator pad. This process effectively de-entrains particulates and liquid before the off-gas leaves the top of the duct. The off-gas combines with the off-gas from an evaporator and is routed to a siphon break. Off-gas piping to this point is made of stainless steel.

The off-gases are vented to a CPVC duct at the siphon break. The siphon break allows sufficient room air to merge with the off-gas from the furnace to cool the air stream. An insertion thermometer is installed in the CPVC duct near the tie-in to the PVC duct to allow monitoring of the off-gas temperature during operation and ensure that the temperature is maintained below 140°F.

10.3.3.1.4.2 Downblending Conversion Furnace

Off-gas from the LEU conversion furnace is vented through two mesh filters and a separator to collect and reflux the acid gas condensing in the ductwork. The condensed acid is returned to the process. The off-gas is cooled by a water-cooled heat exchanger prior to a condensate trap to remove excess moisture. The cooled off-gas is then vented to a fin tube heat exchanger prior to the ductwork material changing from stainless steel to CPVC. The ductwork changes to PVC at the connection to the Blendstock Dissolver Tank. The combined off-gas streams are vented to the NO_X Scrubber.

10.3.3.1.4.2.1

Nuclear Safety

The off-gas vent system is designed to remove uranium from the gas stream prior to entering the ductwork leading to the NOx scrubber or to the condensate storage tanks. If uranium builds up in the ductwork leading to the NOx scrubber it will remain subcritical because the piping is approximately eight inches in diameter which is critically safe for enrichments up to 6 wt. %. If uranium builds up in the duct connected to the furnace it will also remain subcritical due to geometry control.

The gaseous effluent from the LEU conversion furnace exits the converter at the front end of the system. The gaseous effluent first passes through a plenum chamber into a 6-inch diameter duct to reduce the velocity of the gases. Two demister pads are located in the 6-inch diameter duct to separate condensing acid gases and particulate from the off-gas. The off-gas enters an off-gas separator (8-inch square baffle chamber with demister pad) to provide additional separation of condensing acid gases and particulate.

Less than 10% of the uranium input to the furnace exits with the off-gases and less than 0.1% of the uranium that exits the furnace reaches the scrubber. During operation, no more than [redacted] of uranium would be transferred to the scrubber in any 24 hour period during operations and no more than about [redacted] U would be transferred during an abnormal event where the entire contents of the furnace reached the scrubber.

10.3.3.1.4.2.2

Fire Safety

The LEU conversion furnace is equipped with over-temperature controls to prevent overheating. Off-gases vented from the LEU Conversion Furnace pass through stainless steel ductwork. An un-insulated section of duct and a water-cooled heat exchanger downstream of the Off-Gas Separator cool the gases. An additional over-temperature controller shuts down the conversion process and the purge air flow if ductwork temperature downstream of the heat exchanger exceeds setpoint.

Off-gases vented from the LEU conversion process are vented through un-insulated stainless steel duct to a condensate trap. Downstream of the condensate trap the off-gases are vented through un-insulated stainless steel and a fin tube heat exchanger before the material of construction changes to CPVC duct. An insertion thermometer is installed in the CPVC duct prior to the PVC duct tie-in to allow

monitoring of the off-gas temperature during operation and ensure the temperature is maintained below 140°F.

10.3.3.1.4.3 NO_X Process Scrubber

The NO_X process scrubber (T-180) provides off-gas ventilation for the Dissolver Trays in the 230 Building, the NOx reducing agent Feed Tank (T-181), and the NO_X Blowdown Tank (T-182). The NO_X process scrubber also provides off-gas ventilation for the Blendstock Dissolver Tank T21 and the LEU conversion furnace. The NO_X Process Scrubber is shown on Figure 10.3.

The NO_X process scrubber is a four-stage sieve tray design used to remove NO by scrubbing with a solution. The re-circulated solution enters a sieve tray tower and gravity flows through a series of weir plates to improve gas-liquid contact. The NO is removed by reducing NO to nitrogen (N_2) with the addition of an NOx reducing agent and by absorbing NO by reacting with sodium hydroxide (NaOH). Acid vapors are also neutralized by the sodium hydroxide. The scrubbed off-gases exit through a mist eliminator. A booster fan is used to overcome the pressure drop through the NO_X scrubber prior to entering the existing ductwork for the 200 Complex process ventilation system. A duct vacuum switch monitors the exhaust from the booster fan to ensure that if the duct pressure is positive the booster fan will shutdown.

The NO_X process scrubber is equipped with a PLC (programmable logic controller) to provide automatic control of the water level, pH, Oxidation/ Reduction Potential (ORP), and Conductivity. Each PLC control loop activates an alarm horn and displays the PLC's alarm screen in the event that a high or low alarm is activated. The PLC measures the inlet air temperature and activates an alarm if the inlet air temperature exceeds 160°F.

The water level control loop and sensor operate a process water fill valve to maintain water volume in the scrubber for operating the recirculation pump. The pH control loop and sensor operate a NaOH feed valve to maintain the pH in the range of 10 to 12. The NaOH is supplied to the scrubber by the existing NaOH pump and feed tanks (located in the 225 Building Caustic Room) which supply NaOH to the existing scrubber system. The ORP control loop and sensor control the NaHS feed pump to maintain NaHS concentration in the scrubber solution. The NOx reducing agent is pumped from a Feed Tank (T-181) which has a 100 gallon capacity.

The conductivity control loop and sensor operate the blowdown valve to limit solids accumulation in the NO_X scrubber. When the conductivity exceeds the

setpoint, solution is transferred by the NO_x scrubber recirculation pump to the NO_x scrubber blowdown tank which has capacity of approximately 750 gallons. Process water that is added to maintain the water level reduces the conductivity of the scrubber solution.

The scrubber solution in the blowdown tank is treated with calcium hypochlorite to oxidize the residual NOx reducing agent to prevent the formation of hydrogen sulfide gas. The effluent solution is transferred to the T-2/T-3 Waste Tanks for subsequent transfer to the Waste Water Treatment Facility.

10.3.3.1.4.3.1

Nuclear Safety

Under normal conditions there will be insignificant quantities of fissile material allowed in the NOx scrubber. The lids to tanks in the system are listed as SRE and will be locked closed to prevent any unauthorized additions of fissile material. No fissile solution lines are overhead. Therefore, an inadvertent addition of fissile solution to the NOx scrubber is not likely. In addition, a criticality event in the scrubber system is not credible due to the various administrative and engineered controls for the scrubber system as well as the nature and design of the processes that send off-gases to the scrubber system.

Criticality safety of the scrubber is maintained by limiting the mass of ^{235}U in it to no more than 45% of the minimum critical mass of uranium. The most likely scenarios of the accumulation of excessive amounts of uranium in the scrubber would involve failures in the administrative controls that: 1) require the scrubber solution to be sampled and analyzed at a particular frequency, or 2) require the scrubber system to be NDA scanned periodically. Normally the concentration in the scrubber solution will be $<<0.1$ $g^{235}U$/liter and the total holdup in the scrubber system will be $<<350$ $g^{235}U$.

10.3.3.1.4.3.2

Fire Safety

Off-gas from the NO_x generating processes are vented to the NO_x process scrubber through PVC ductwork (140°F recommended maximum operating temperature). The scrubber tank and all internal components are made from fire-retardant polypropylene with a heat of distortion temperature of 269°F at 66 psig liquid service. The scrubber is designed to operate at -20 inches of water at a temperature of 180°F. The scrubber solution piping is made of CPVC. The pumps, valves and instrumentation are made of various plastics (polypropylene, PVC, CPVC, kynar, viton, teflon, etc.). The booster fan and the inlet throttle damper are made of fire-

retardant FRP with a flame spread rating of 25 or less. The booster fan is rated for service to 250°F. The inlet throttle damper is rated for service to 200°F.

10.3.3.11 BLEU Complex Uranyl Nitrate Building, Bldg. 510

10.3.3.11.1 PEVS Description

Outside air flow will be controlled via an automatic damper (PCV-5101) and filtered prior to mixing. Circulation air flow (FE-510R) will be controlled by blower motor speed controller (B-510R). Circulated air will be filtered (F-510R) and mixed with the outside air upstream of the heating and cooling unit.

The heating and cooling unit will be located in the mechanical equipment room. The air will be cooled or heated and distributed throughout the controlled area. The heating unit will be natural gas powered. Building temperature TI-5101 is maintained by controlling the set point of circulation heating (TIC-510RH) and cooling (TIC-510RC).

Room pressure will be maintained negative with respect to atmosphere. Building negative (PI-5101) is maintained by controlling the exhaust blower (B-510E) speed. All exhaust air will be HEPA filtered (F-510E1) prior to discharge to the atmosphere.

10.3.3.11.2 Nuclear Safety

The design of the tanks in the UNB precludes uranium from entering the tank vents. Double contingency is met by the drains and tank overflow lines which prevent accumulation of uranium in unfavorable geometry duct work. Periodic surveillance verifies the absence of measurable quantities of uranium. Ventilation HEPA filter differential pressure will be monitored and changed as necessary.

10.3.3.11.3 Fire Safety

Fire suppression sprinklers are installed throughout the building excluding the electrical room. Uranyl nitrate storage tank vent piping material will not support combustion and is rated as self extinguishing per UL 94. An ionization type smoke detector is installed in the exhaust duct downstream of the HEPA filter. An ion type smoke detector is also installed in the circulation duct. The exhaust stack is grounded per NFPA 780.

10.3.3.12 **BLEU Prep. Facility, Bldg. 333**

The description of the PEVS in Bldg. 333 is provided in the BLEU Prep. Facility ISA Summary Document.

CHAPTER 10

H. WASTE

10.4 RADIOACTIVE WASTE HANDLING

10.4.1 Liquid Wastes

Liquid wastes are discharged from the Plant through two routes: process wastes and sanitary wastes.

10.4.1.1 Process Wastes

Most process waste water is collected in tanks in or near the various process buildings. Prior to pumping these wastes to the Waste Water Treatment Facility (WWTF), they are analyzed and must show levels below internal action guide limits. Waste water generated in the following processes is currently treated in the WWTF:

- Fuel Manufacturing
- Highly Enriched Uranium Fuel Recovery
- Laboratories
- Decontamination
- Fuel Development
- Decommissioning activities
- Laundry
- Mixed Waste Treatment
- BLEU Preparation

The WWTF is operated in accordance with a State of Tennessee issued NPDES permit. Waste water is treated in the WWTF on a batch basis with discharge directly to the Nolichucky River. The average discharge is approximately 15,000 gallons. The specific process description is included in Chapter 15.

In this facility, waste water is treated for removal of fluorides by precipitation. The precipitate is de-watered, and the solids are packaged for land-burial. The solutions may undergo ammonia removal by use of a stripping tower or by break-point chlorination prior to neutralization for discharge. The treated water is discharged directly to the Nolichucky River. A sample from each batch is collected and analyzed prior to discharge to assure compliance with 10 CFR Part 20 and applicable State of Tennessee regulations.

10.4.1.2 Sanitary Wastes

Plant sanitary wastes are discharged to a line which goes to the City of Erwin publicly owned treatment works. The inputs for the sanitary sewer system include all bathrooms and showers (as outlined in Figure 10.16). Water from the Groundwater Treatment Facility is also discharged in accordance with all applicable regulatory requirements. Samples are collected from the sewer pipe at a point downstream from all Plant inputs to assure compliance with 10 CFR 20.2003 and applicable State of Tennessee regulatory requirements.

10.4.2 Solid Wastes

Solid waste materials generated as a result of operations at the NFS Erwin Facilities are of four types: radiologically contaminated waste, non-contaminated solid waste, hazardous waste and mixed waste (hazardous and radioactive).

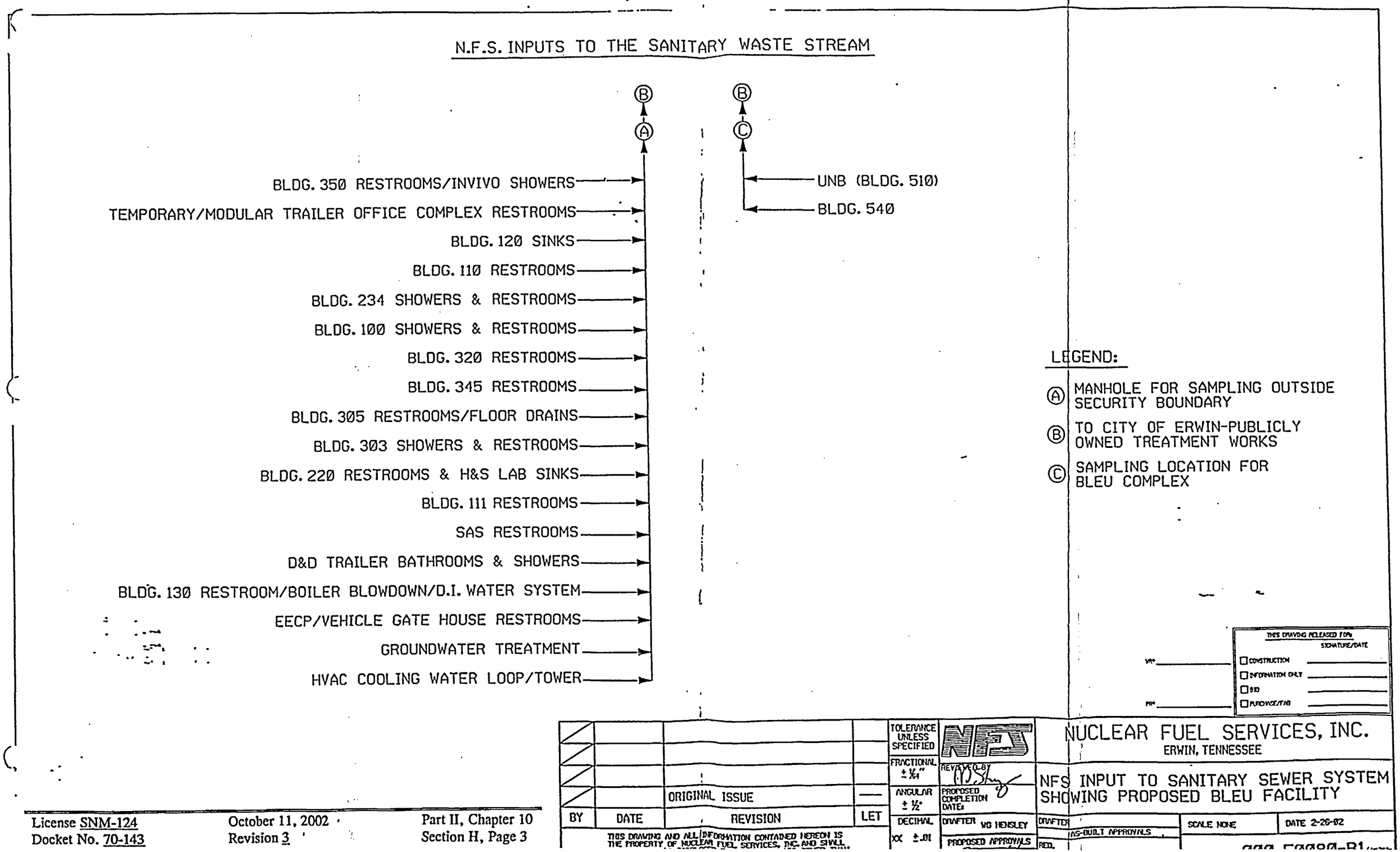
10.4.2.1 Radiologically Contaminated Waste

Radiologically contaminated wastes may be additionally processed by sorting, segregation, blending, mixing, volume reduction, and/or shipment to a licensed disposal facility.

10.4.2.2 Non-contaminated Solid Waste

Non-contaminated combustible materials, such as office and lunchroom trash, and non-contaminated, non-combustible waste, including normal industrial materials, metals and construction rubble, are disposed of at a local permitted landfill.

Figure 10.16
NFS Inputs to the Sanitary Waste Stream



10.4.2.3 Hazardous Waste

Hazardous waste that is generated at the site may be treated on-site or stored in a designated 90-day storage area prior to treatment and/or disposal at a permitted facility.

10.4.2.4 Mixed Waste

Mixed waste is waste that is both hazardous (as defined by EPA) and radioactive. Mixed waste may be treated to remove the hazardous characteristics or stored in an on-site permitted storage facility. Mixed waste may be shipped for treatment and/or disposal to a permitted and licensed facility as such facilities become available.

10.4.2.5 General

Approved procedures are used to identify, control, store, and dispose of all waste material.

CHAPTER 10

I. FIRE PROTECTION

10.5 FIRE PROTECTION

10.5.1 Fire Protection Program

The NFS Fire Protection Program is designed, implemented, and assessed to meet the following objectives:

- Minimize the potential for the occurrence of a fire or related perils.
- Ensure that fire does not cause an unacceptable on-site or off-site release of hazardous material that will threaten the public health and safety or the environment.
- Establish requirements consistent with the National Fire Protection Association (NFPA) 101, *Life Safety Code*, that will provide an acceptable degree of life safety to NFS, Nuclear Regulatory Commission (NRC), and contractor personnel.
- Ensure that process control and safety systems are not damaged by fire or related perils.
- Ensure that essential programs or projects will not suffer unacceptable delays as defined by the senior program official as a result of fire and related perils.
- Ensure that property damage from fire and related perils does not exceed NFS established levels.

The Fire Protection Program responds to the following documents and criteria, where they are applicable: NRC Branch Technical Position for Fire Protection of Fuel Cycle Facilities; Southern Building Code Congress, International, Inc. (SBCCI); NFPA Codes and Standards; and, Code of Federal Regulations (CFR), Title 29, Parts 1910 and 1926 (29 CFR 1910 and 1926).

The facility and processes have been insured for nuclear liability and property coverage by American Nuclear Insurers (ANI) and ACE, respectively. The Nuclear Liability Insurance Endorsement is maintained on file at NFS.

10.5.2 Administrative Controls

10.5.2.1 Fire Protection Plan

Details of the NFS fire protection plan, including organization, management responsibility, training, inspection, equipment testing, etc., are included in approved program documents and procedures.

10.5.2.2 Facility Audits

Facility audits and inspections are performed at two levels, as follows:

1) Routine audits and inspections are performed that include fire protection, combustible loading, and housekeeping status.

2) ANI and ACE are responsible for performing independent fire prevention, protection, and fire brigade inspections of the facility.

3) Action plans are developed to address findings from these inspections.

10.5.3 Building Design

10.5.3.1 Fire Areas

Fire areas subdivide specified processes or materials involving significant fire hazards, to confine the spread of fire to the area of origin. In particular, the building areas are considered and fire barriers provided as recommended by a fire hazard analysis.

10.5.3.2 Means of Egress

To enable rapid egress from the facilities in the event of a fire, NFS utilizes the applicable portions of guidance from NFPA 101, Life Safety Code.

10.5.3.3 Exposure Fire Risk

To minimize exposure fire risk, NFS employs the applicable portions of guidance from NFPA 80A, Recommended Practice for Protection of Buildings from Exterior Fire Exposures.

10.5.3.4 Nuclear Processing Facilities

Design and construction criteria for facilities for processing uranium include an evaluation to determine the appropriate methods to prevent, detect, extinguish, limit, and control fires and explosions. Fire-resistive and non-combustible materials are used where possible.

10.5.3.5 Flammable and Combustible Liquids

When the use of flammable or combustible liquids cannot be avoided, the reduction of risk and hazard from fires involving these materials is accomplished by the use of minimum volumes of liquids; by isolation with fire barriers; by isolated location; by provision for automatic fire suppression; and by installation of catch basins designed to minimize the spread of fluid leakage, as appropriate, for the fire hazard.

NFPA 30, Flammable and Combustible Liquids Code, is used as a guideline for the handling, use, and storage of flammable or combustible liquids.

10.5.3.6 Combustible and Flammable Gases

Systems using combustible and flammable gases are installed in accordance with the applicable NFPA standards. Ventilation systems exhausting combustible and flammable vapors at concentrations between 25 percent (25%) or greater of their lower flammable limit (LFL) and the upper flammable limit (UFL) are constructed of non-combustible materials in accordance with NFPA standards.

10.5.4 Water Supply

Plant fire protection water is provided through a loop system with two independent 8-inch connections to the City of Erwin systems. The first lead in is supplied from the city distribution system and the second lead-in is supplied from a 634,000 gallon steel reservoir located on the hill north of the facility. Each connection to the city supply is arranged in a standard pit (vault) with a single check valve and an isolation valve.

Figure 10.17 gives the details of this system. The Erwin system details are discussed briefly in Section 10.2.3. Fire protection connections to the City system, downstream from the vaults, are independent of those providing water to the Plant for other purposes. Post indicator sectional valves are provided as appropriate to isolate portions of the system should the need arise. The NFS system contains several fire department connections which allow tankers to pressurize all or certain portions of the system should the need arise.

10.5.5 Hydrants and Hose Houses

Numerous hydrants and hose houses are provided throughout the fire protection loop (see Figure 10.17). Locations are such that they allow ready access for quick use when needed to assist in fire fighting. In addition, several hose houses are provided on major process building roofs. Hydrants and hose houses are installed and equipped in accordance with the applicable NFPA standard. Two monitor nozzles are included on the fire protection loop to be utilized in the event of a need in the bulk chemical facility.

10.5.6 Fixed Fire Protection Systems

Fixed fire protection systems, including automatic sprinkler, carbon dioxide, and Halon systems, are utilized throughout the Plant. Fire hazard analyses are performed to confirm the adequacy of the fire suppression system to respond to the maximum credible fire scenario. These systems are installed and periodically checked as required by applicable standards. Automatic systems are located in various facilities as presented in Table 10.1.

10.5.7 Fixed Fire Detection Systems

Several areas within the Plant are equipped with fixed fire detection systems. Fire hazard analyses are performed to confirm the adequacy of the fixed fire detection system to respond to the maximum credible fire scenario. These systems include both smoke detectors and heat sensors. Heat sensors operate on both a fixed temperature and rate compensated basis. Detection systems are all equipped with local alarming circuitry. NFPA 72, National Fire Alarm Code, is utilized as a basis for the design, installation, and testing of the fire detection and alarm systems. Fire detection systems located in various facilities are presented in Table 10.1.

10.5.8 Portable Fire Extinguishers

There are over 300 portable fire extinguisher locations established throughout the Plant, as required by applicable standards.

10.5.9 Plant General Alarm

In addition to the numerous local alarms associated with the various fixed protection and detection system, the Plant has a Plant-wide manual pull-box fire alarm capability. The system is integrated into the Plant's central alarm panel which also serves the criticality monitoring system. As such, this system is equipped with an uninterrupted power supply.

The fire alarm tone provided by this system is different from the criticality evacuation tone. The alarm is sounded bi-monthly to keep all personnel aware of the different tones. When activated, the alarm can be heard throughout the Plant. Fire brigade members are trained to respond to the fire alarm system.

The central alarm panel is located in Building 105A. It also remotely reports alarm conditions to two locations: Building 220, Safety Laboratory; and Building 301, Security Secondary Alarm Station.

10.5.10 Fire Brigade

NFS maintains an organized group of employees who are knowledgeable, trained, and skilled in basic fire-fighting operations. Training and education are provided for fire brigade members commensurate with those duties and functions that fire brigade members are expected to perform.

Fire-fighting equipment is provided for the fire brigade and maintained in a plant fire brigade ready room to assure the safe operational condition of the equipment.

10.5.11 Pre-Fire Plans

NFS maintains pre-fire plans that provide information needed by fire fighting personnel responding to the emergency. These pre-fire plans are also distributed to the local fire departments which may respond to an emergency at NFS.

Figure 10.17
PLANT FIRE LINES

Table 10.1

FIXED FIRE SUPPRESSION AND DETECTION SYSTEM LOCATION SUMMARY

Facility Suppression Matrix							
Facility No.	System Type					Area of Coverage	Comments/ Remarks
	Wet	Dry	Deluge	PA	Other		
100	X					Complete Coverage	
104	X					Complete Coverage	
105	X					Complete Coverage, excluding the wet lab area	
	X				Manual	Fiberglass Hoods	
110		X				Complete Coverage in Areas A & B	
120	X					Complete Coverage	
130	X					Complete Coverage, excluding the mezzanine area	
220	X					Partial Coverage	
230	X					Complete Coverage in office areas	
233	X					Partial Coverage	
300 A/B		X				Complete Coverage	
301A	X					Building Heating Room and Calibration Furnace Only	
					Halon 1301	Security Secondary Alarm Room	Total flooding system
302				X	Carbon Dioxide	Solvent Extraction, Areas 300-500	Primarily a local application system, can be activated by installed heat detectors or by manual pull stations located adjacent to the coverage zones
304	X					Partial Coverage	
305	X					Complete Coverage	
			X		Halon 1301	Security Process Area	Total flooding system
306	X					Partial Coverage	
320	X					Complete Coverage	
333					AFFF Foam ABC Dry Chem	Solvent Extraction LEU/HE Offices and Locker Rooms	
340	X					Complete Coverage	
345	X					Complete Coverage	
				X		Computer Room	
350	X					Complete Coverage	
310					ABC Dry Chemical	HAZMAT Locker	
T-12					ABC Dry Chemical	Complete Coverage	

Facility Detection Matrix					
Facility	Smoke		Heat		Comments/Remarks
	Ion	Photo	Fixed	Rate Compensated	
105	X				Record Storage Vault Only
301	X				Security Room (SAS) Only
302	X	X	X	X	Photo smoke in Area 800, balance Ionization Fixed Heat In Area D calciner, rate compensated heat in CO_2 system coverage area
305	X				Security Badging and Control Alarm Station Only
306	X				Vault, beam detection in 306 East
310			X		Complete Coverage
333	X	X	X		Complete Coverage
345	X				Duct Detection Also

10.5.12 Fire Hazard Analyses

Fire Hazard Analyses (FHAs) are developed to address the requirement for facility-related FHA's as outlined in the Nuclear Regulatory Commission (NRC) Branch Technical Position (Guidance on Fire Protection for Fuel Cycle Facilities). These documents, which are prepared for NFS facilities which are involved in the processing or storage of nuclear materials, evaluate the current levels of fire protection and life safety features present in the building. FHAs are also prepared for non-nuclear facilities which may present an unusual fire risk. These documents are in place for the following NFS facilities; 312, 100, 111, 110, 120, 131, 132, 133, 330, 310, 130, 200 Complex, 300 Complex and 300 A/B warehouses. FHAs, which are developed in conjunction with an outside fire protection engineering consultant, generate recommendations which are prioritized and tracked until resolved. Additionally, these documents are revised in response to facility modifications which may impact fire risk.

CHAPTER 13

ENVIRONMENTAL PROTECTION

A. *ENVIRONMENTAL PROTECTION*

13.1 SUMMARY OF ENVIRONMENTAL DATA AND IMPACTS

Complete radiological and non-radiological environmental summaries for the NFS Erwin facility are included in the NFS Environmental Report, dated December 1996 (submitted to the NRC May 2, 1997). A summary of the NRC's Environmental Assessment and its Finding of No Significant Impact (FONSI) to the 1999 renewal of SNM-124 is included in a 1999 notice in the Federal Register (Vol. 64, No. 23, pp. 5681 - 5683).

A Supplemental Environmental Report provides a summary of radiological and non-radiological impacts attributable to the Blended Low-Enriched Uranium (BLEU) Project. This Supplemental Environmental Report specified the environmental impacts associated with constructing and operating the Uranyl Nitrate Building, BLEU Prep. Facility (BPF), Oxide Conversion Building, and Effluent Processing Building. The NRC noticed an EA/FONSI in the Federal Register (Vol. 67, No. 131, P. 45555-45559) concerning the license amendment needed to construct and operate the Uranyl Nitrate Building on July 9, 2002. Additionally, this EA/FONSI served to address the impacts associated with increasing the possession limit from [redacted] to [redacted] of ^{235}U and those attributable to the entire BLEU Project.

13.2 OFF-SITE DOSES

Since 1981, NFS has routinely calculated doses to members of the general public due to air effluents by operating stacks. These calculations utilize data from the air effluent monitoring program, along with site-specific meteorological data and physical characteristics of stacks. A summary of the results of these calculations for the maximally exposed individual for the period 1992 through the fourth quarter of 2001 are given in Table 13.1.

13.3 EFFLUENT CONTROL AND ENVIRONMENTAL MONITORING

Effluent monitoring and environmental monitoring are implemented through compliance with a number of Safety Department procedures. These procedures outline: sampling technique, sample processing and analysis methodologies, quality assurance, and other necessary information for maintaining a viable program.

Current sampling locations are identified in Table 13.2 and Table 13.3. These tables may also include sampling locations that are not required by license SNM-124 and applicable regulations. The minimum environmental protection sampling locations are identified in Chapter 5 of Part I. Action levels associated with effluent monitoring and environmental monitoring are provided in Table 5.1 of Chapter 5, Part I of this license.

13.3.1 Air Sampling

Airborne effluents from process ventilation stacks and vents are sampled continuously for radioactivity, during the processing of radioactive materials. Samples, representative of the total discharge, are routinely collected at frequencies specified in Safety Department procedures. All airborne effluent samples are analyzed for gross alpha and gross beta radioactivity.

Ambient air is continuously monitored at onsite and offsite locations. All environmental ambient air samples are analyzed for gross alpha and gross beta radioactivity, and are composited and analyzed for specific radionuclides.

13.3.2 Liquid Sampling

The Wastewater Treatment Facility (WWTF) treats and discharges process wastewater on a batch basis. Prior to discharge, each batch is sampled and analyzed for gross alpha and gross beta radioactivity as well as selected chemical parameters. The WWTF batches are discharged when they meet regulatory compliance parameters. The batch samples collected from the WWTF are composited and analyzed for specific radionuclides.

The Groundwater Treatment Facility (GWTF) discharges liquid effluents to the Sanitary Sewer. When operating, a grab sample is obtained from the GWTF. The grab sample(s) are composited and analyzed for insoluble radioactivity. The Sanitary Sewer discharges to the City of Erwin - Publicly Owned Treatment Works (POTW), and is sampled continuously using a proportional sampler. Sanitary Sewer samples are composited and analyzed for specific radionuclides.

Storm water is discharged to Banner Spring Branch. Banner Spring Branch is sampled continuously at a downstream location with a proportional sampler. Routine grab samples are collected from an upstream location. These samples are composited and analyzed for specific radionuclides.

NFS routinely collects grab samples from locations that are upstream and downstream of the NFS facility along Martin Creek and the Nolichucky River.

Individual grab samples are analyzed for specific radionuclides, and the grab samples from the downstream locations are composited prior to analyzing them for specific radionuclides. Non-routine locations such as the Valved Surface Drainage Holding Area are periodically sampled in addition to the routine samples.

The site groundwater monitoring wells are shown in Figure 13.1. These site wells include those located inside of the protected area and those located in the former burial grounds, outside of the protected area to the north and the west. A number of wells are sampled both monthly and quarterly and analyzed for both chemical and radiological parameters. The routine radiological parameters are gross alpha and gross beta activity. If the action points of 15 pCi/liter alpha or 50 pCi/liter beta activity are exceeded, isotopic analysis will be performed.

Two leak detection wells are located to the north and west of the two underground 6000-gallon tanks. These wells, shown in Figure 13.2, will be sampled on a quarterly basis when the tanks are in use.

13.3.3 Soil, Sediment and Vegetation

Soil, sediment, and vegetation grab samples are routinely collected from the locations listed in Table 13.2. Soil sampling is typically restricted to the surface layer, which is indicative of the recent deposition of airborne radioacivity at a given location. Sediment sampling emphasizes shallow sediments, which is indicative of recent deposition from liquid effluents. Vegetation sampling relies primarily on annual plant growth, which is indicative of the radioactivity taken up through the roots and deposited on plant surfaces. In addition, sludge samples are routinely collected from the City of Erwin POTW and analyzed for uranium isotopes.

13.3.4 Environmental Dosimeters

Dosimeters are placed on and off site in order to routinely assess ambient radiation levels at the selected locations. The data from these dosimeters are used to demonstrate compliance with the 10 CFR Part 20, Subpart D requirement.

TABLE 13.1

RESULTS OF QUARTERLY DOSE ASSESSMENTS FOR THE MAXIMALLY EXPOSED OFF-SITE INDIVIDUAL

Period	Maximum TEDE (mrem)	Maximum CDE (mrem)	Maximally Exposed Organ	Location of Maximum Exposure	
				Sector	Distance (m)
1st Qtr. 1992		0.18	Child-Lung	S	405
2nd Qtr. 1992		0.09	Child-Lung	S	405
3rd Qtr. 1992		0.27	Child-Lung	S	405
4th Qtr. 1992		0.08	Child-Lung	S	405
1st Qtr. 1993		0.21	Child-Lung	S	405
2nd Qtr. 1993		0.29	Child-Lung	S	405
3rd Qtr. 1993		0.21	Child-Lung	S	405
4th Qtr. 1993		0.11	Child-Lung	S	405
1st Qtr. 1994		0.01	Child-Lung	SSW	210
2nd Qtr. 1994		0.02	Child-Lung	SSW	210
3rd Qtr. 1994		0.02	Child-Lung	SSW	210
4th Qtr. 1994		0.02	Child-Lung	ESE	300
1st Qtr. 1995		0.05	Child-Lung	ESE	300
2nd Qtr. 1995		0.02	Child-Lung	ESE	300
3rd Qtr. 1995		0.02	Child-Lung	ESE	300
4th Qtr. 1995		0.02	Child-Lung	ESE	300
1st Qtr. 1996		0.05	Child-Lung	SE	215
2nd Qtr. 1996		0.03	Child-Lung	ESE	300
3rd Qtr. 1996		0.04	Child-Lung	SE	215
4th Qtr. 1996		0.05	Child-Lung	SE	215
1st Qtr. 1997		0.07	Child-Lung	SE	215
2nd Qtr. 1997		0.03	Child-Lung	SE	215
3rd Qtr. 1997		0.05	Child-Lung	NNE	210
4th Qtr. 1997		0.04	Child-Lung	NNE	210
1st Qtr. 1998	0.004	0.03	Lung	NNE	250
2nd Qtr. 1998	0.073	0.43	Lung	NNE	650
3rd Qtr. 1998	0.013	0.10	Bone Surfaces	NNE	200
4th Qtr. 1998	0.011	0.07	Lung	NNE	550
1st Qtr. 1999	0.009	0.06	Bone Surfaces	NNE	500
2nd Qtr. 1999	0.012	0.13	Bone Surfaces	NNE	300
3rd Qtr. 1999	0.013	0.14	Bone Surfaces	NNE	300
4th Qtr. 1999	0.020	0.07	Bone Surfaces	NE	100
1st Qtr. 2000	0.014	0.09	Bone Surfaces	SSE	900
2nd Qtr. 2000	0.013	0.13	Bone Surfaces	NNE	300
3rd Qtr. 2000	0.006	0.06	Bone Surfaces	NNE	300
4th Qtr. 2000	0.005	0.04	Bone Surfaces	NNE	300
1st Qtr. 2001	0.005	0.05	Bone Surfaces	NNE	300
2nd Qtr. 2001	0.010	0.06	Lung	NNE	250
3rd Qtr. 2001	0.007	0.05	Lung	NNE	300
4th Qtr. 2001	0.009	0.06	Lung	NNE	250

NOTES

TEDE is the total effective dose equivalent from air emissions for period (NFS began reporting TEDE the 1st Qtr 1998)

CDE is the committed dose equivalent to the maximally exposed organ from air emissions during period

All dose predictions represent 50-year dose commitments for internal exposure pathways

As of the 1st quarter of 1998 assessment techniques changed and doses are now computed using the CAP88-PC computer code

Table 13.2
ENVIRONMENTAL MONITORING
SAMPLING LOCATIONS

SURFACE WATER	GROUND WATER	AMBIENT AIR	VEGETATION	SOIL/SEDIMENT
Martin Creek Upstream Sampling Point		NW Perimeter Air Sampling Sta #170	Asheville Highway Sampling Point	Asheville Highway Sampling Point (soil)
Martin Creek Downstream Sampling Point	Well LD-1A[2] West of two underground 6,000-gallon tanks	W Perimeter Air Sampling Sta #171	Banner Hill Rd Sampling Point	Banner Hill Rd Sampling Point (soil)
Banner Spring Branch Downstream[1] Sampling Point		S Perimeter Air Sampling Sta #172	Little Mountain Sampling Point	Little Mountain Sampling Point (soil)
Banner Spring Branch, Upstream Sampling Point	Well LD-2A[2] North of two underground 6,000-gallon tanks		Burial Ground Sampling point	Highland Ave/First St Sampling Point (soil)
	Well 52 Background Well		Highland Ave/First St Sampling Point	Burial Ground at Sampling Point (soil)
Nolichucky River Upstream Sampling Point	Wells 98A, 99A, 100A 100B, 101A 102A, 103A	E Perimeter Air #1 Sampling Sta #174		Nolichucky River Upstream Sampling Point (sediment)
Nolichucky River Downstream Sampling Point	104A, 105A, 106A, Quarterly Downgradient Wells	E Perimeter Air #2 Sampling Sta #218		Nolichucky River Downstream Sampling Point (sediment)
				Martin Creek at Upstream Sampling Point (sediment)
	Other[3]	Near Ponds 1 & 2 Air Sampling Sta #555		Martin Creek at Downstream Sampling Point (sediment)
		W Perimeter Air Sampling Sta #668		Banner Spring at Upstream Sampling Point (soil)
Surface Drainage Ditch West Sampling Point		Banner Hill Rd Air Sampling Sta #323		Banner Spring at Downstream Sampling Point (sediment)
		Prk. Lot/Ent Air Sampling Sta #372		
		B. Hill/Stalling Air Sampling Sta #381		

Table 13.2 (Cont.)
ENVIRONMENTAL MONITORING
SAMPLING LOCATIONS

SURFACE WATER	GROUND WATER	AMBIENT AIR	VEGETATION	SOIL/SEDIMENT
		Stalling Ln SE Air Sampling Sta #382		
		Highland/1st St Air Sampling Sta #383		
		Spar Mill Rd Air Sampling Sta #384		
		Security Fence SE Air Sampling Sta #385		
		Asheville Hwy Air Sampling Sta #324		
		North NFS Mound Air Sampling Sta #553		
		Images West Sampling Sta #581		
		NFS Training Center Sampling Sta #582		
		Little Mountain Air Sampling Sta #322		
		E of North NFS Burial Ground Sampling Station #677		
		NE of North NFS Burial Ground Sampling Station #678		
		N of North NFS Burial Ground Sampling Station #679		
		SW Burial Trench Area Sampling Station #685		

NOTES:

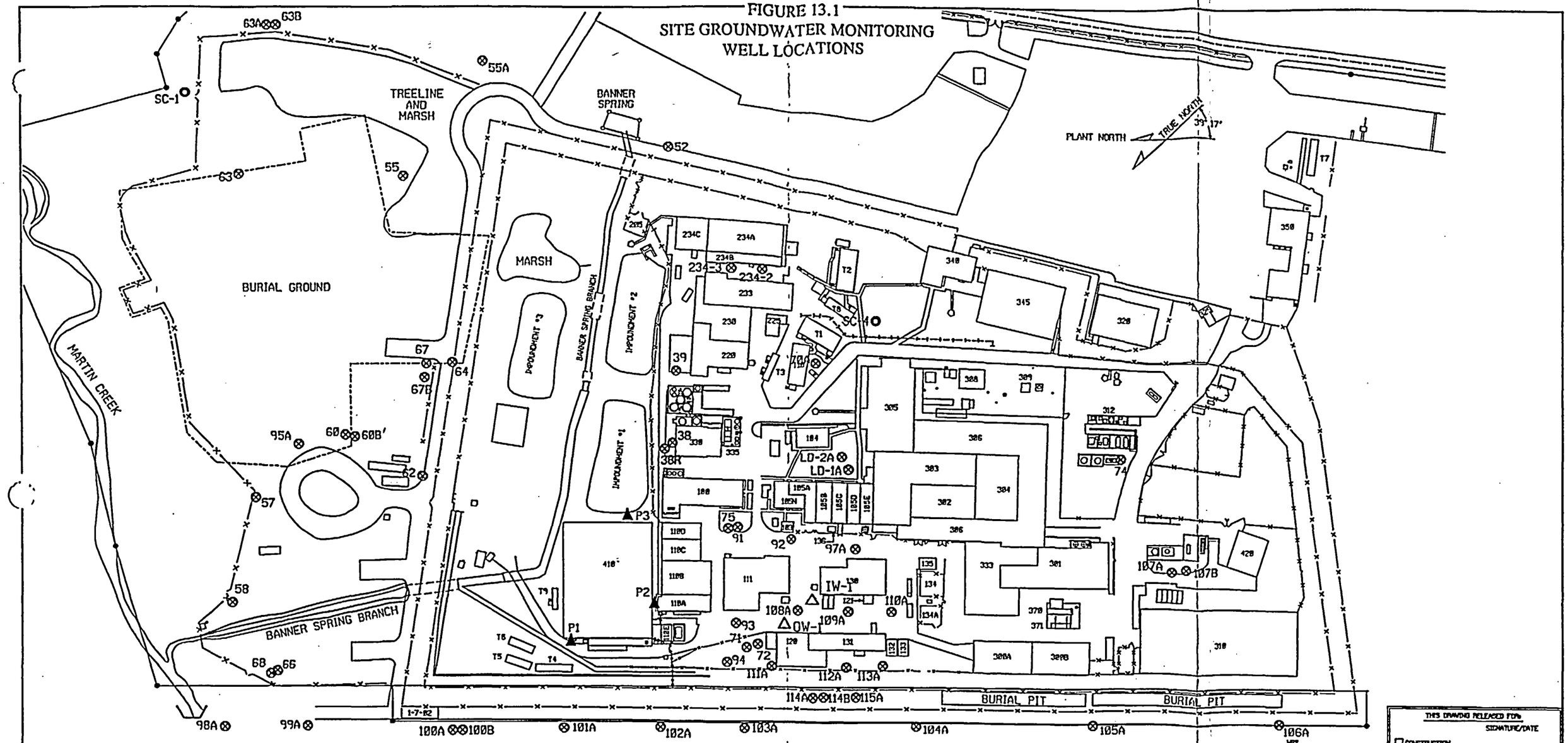
(1) Samples are collected using a continuous, proportional sampler. In the event that this sampler becomes inoperable due to power failure, mechanical breakage, etc., a daily grab sample will be collected.
(2) Wells LD1A and LD2A are routinely collected when the underground storage tanks are in use.
(3) In accordance with established procedures, a number of well samples are collected on a routine basis. At a minimum, these are analyzed for gross alpha and beta radioactivity (see Figure 13.1).

Table 13.3
EFFLUENT SAMPLING LOCATIONS[1]

Gaseous Effluents (Stacks/Vents)	Liquid Effluents (Streams)
Stack 416, Main Stack	Wastewater Treatment Facility (WWTF)
Stack 185, Building 131	Groundwater Treatment Facility (GWTF)
Stack 234, Building 234	Sanitary Sewer
Stack 27, Building 234	EPOTW Sludge
Stack 28, Building 234	
Stack 332, Building 120	
Stack 376, Building 301	
Stack 421, Building 100	
Stack 547, Building 100	
Stack 573, Building 306-W	
Stack 600, Building 110	
Stack 615, Building 306-W	
Stack 646, Building 110	
Stack 649, Building 330	
Stack 667, Building 410	
Stack 703, Building 333	
Stack 704, Building 333	

Note:
1 - Normally, samples are only collected from these locations when discharges occur (i.e. stack/vent operates or facility discharges liquid effluents)

FIGURE 13.1
SITE GROUNDWATER MONITORING
WELL LOCATIONS



LEGEND

- ⊗ - MONITORING WELL LOCATION
- O - PIEZOMETER LOCATION
- ▲ - POND 4 PIEZOMETER LOCATION
- △ - INJECTION WELL AND OBSERVATION WELL LOCATION

BY	DATE	REVISION	LET
		REMOVED ABANDONED WELLS, ADDED POND 4 PIEZOMETERS, WELLS IW-1 AND OW-1	F
MDK/JPS	11-6-98	REMOVED ABANDONED WELLS	E
VGH/JPS	4-29-98	REMOVED ABANDONED WELLS	D
MDK/JG	4-12-96	ORIGINAL ISSUE	—

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ANGULAR ± 1/2°
DECIMAL
XX ±.01
XXX ±.001

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MONITORING WELL AND PIEZOMETER LOCATIONS

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DATE 84-22-82
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DRAWING NO. 000-C0281-B
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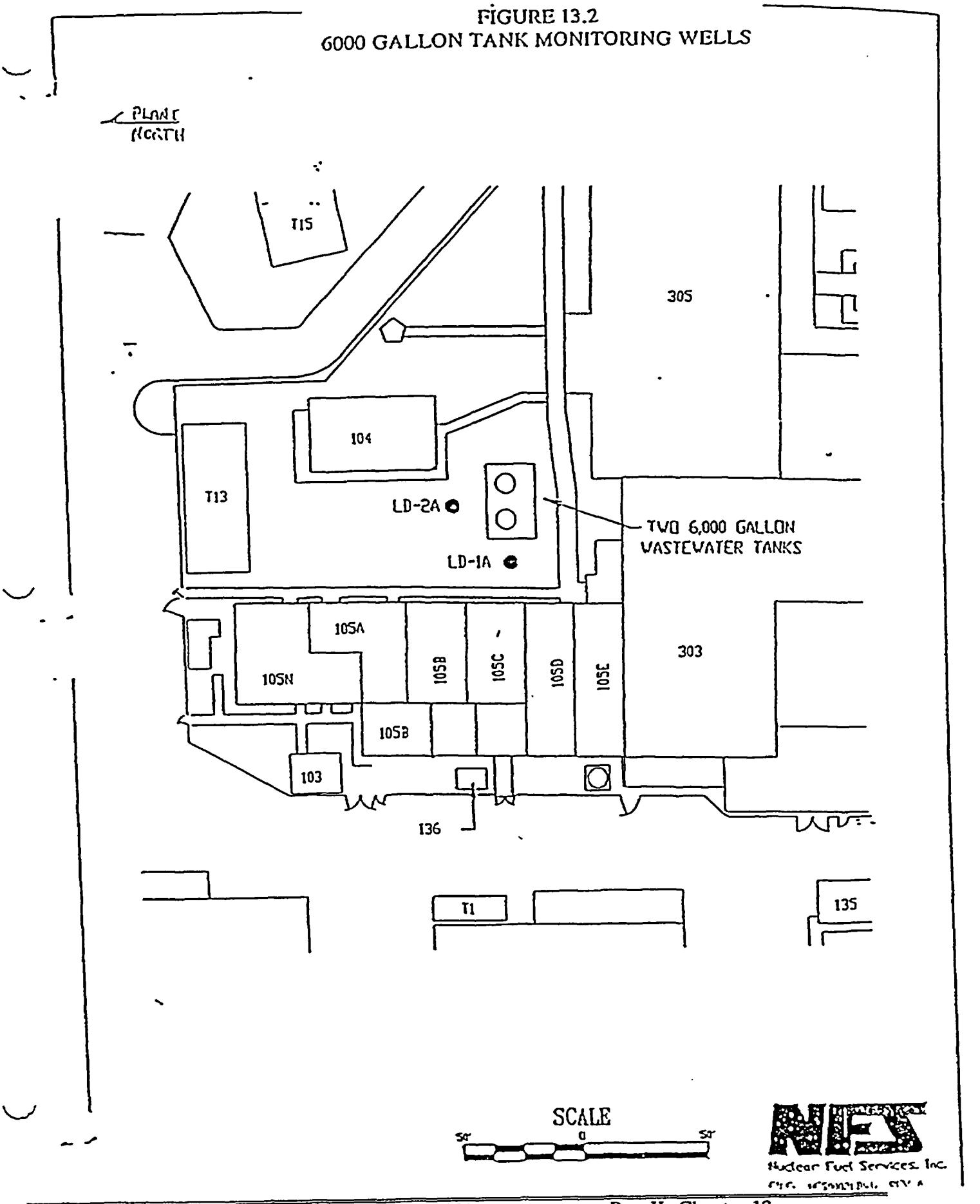
FIGURE 13.2
6000 GALLON TANK MONITORING WELLS



15.13 BLEU PREPARATION FACILITY - BUILDING 333

HE uranium-bearing materials, up to fully enriched in ^{235}U, of various physical forms and chemical compositions are processed in the BLEU Prep. Facility (BPF) in Bldg. 333 to convert the HEU materials to uranyl nitrate solutions. High-Enriched (HE) uranyl nitrate solutions are then downblended to low-enriched (LE) uranyl nitrate solutions using natural (N) uranyl nitrate solution as blendstock in the same building. The location of Bldg. 333 within the Protected Area is shown in Chapter 10, Figure 10.1.

The BPF is composed of the Uranium Metal Process, Uranium Aluminum Alloy Process, Solvent Extraction Process, Enrichment Downblending Process, and Uranium Recovery Process. Descriptions of each of these processes follow:

15.13.1 Safety Considerations

The *BLEU Prep. Facility Integrated Safety Analysis Summary* contains discussions of the criticality safety, radiological safety, chemical safety, fire safety, and environmental safety bases for each of the processes in the BPF. Therefore, the information presented in this section (Section 15.13) is limited to brief descriptions of each of these processes.

15.13.2 Uranium Metal Processing

The Uranium Metal Process is a two-stage operation combining conversion of HE U metal to oxide with the dissolution of the U oxide in nitric acid.

Upon unloading from shipping packages, containers of HE U metal pieces are moved from the shipping/receiving portion of the vault in Bldg. 306 to the storage portion of the vault. Containers of HE U metal pieces are taken to a sampling glovebox for analysis by NFS' Central Laboratory. The containers are opened at the oxidation workstation and the U metal pieces are placed inside the oxidation unit. As the U metal pieces are oxidized the oxide powder falls into a dissolver. Nitric acid is used to dissolve the U oxide. Following dissolution the uranyl nitrate solution is pumped through a filter to test columns. After being held in the test column, the solution is moved to the HEU Mix/Measure Columns when needed as feed for the HEU to LEU downblending process.

15.13.3 Uranium Aluminum Alloy Processing (UAlx)

The UAl_x Alloy Process consists of six stages within the BPF to convert HE UAlx alloy ingots to impure uranyl nitrate solution. These stages are: container storage, caustic dissolution, U solids separation, nitric acid dissolution, uranyl nitrate solution measurement, and used caustic solution collection/measurement.

Upon unloading from shipping packages, containers of HE UAl_x alloy ingots are moved from the shipping/receiving portion of the vault to Bldg. 333. The containers are stored in the high security storage area inside Bldg. 333. When needed for processing, containers of UAl_x alloy ingots are taken to a workstation and opened. The ingots are moved directly to a dissolver and placed into the dissolver. Sodium hydroxide (caustic) solution is trickled over the ingots in the dissolver to preferentially dissolve the aluminum, leaving the uranium in solid form. The uranium solids are then separated from the caustic solution. The caustic solution, with the aluminum, is collected, measured for SNM and pumped to the WWTF to be treated. The uranium solids are then dissolved in nitric acid to form an impure uranyl nitrate solution. The impure uranyl nitrate solution is pumped through a filter to the UAl_x Accountability Columns and measured for SNM. After it is measured the uranyl nitrate solution is then pumped to the Solvent Extraction Process.

15.13.4 Uranyl Nitrate Purification (Solvent Extraction)

The purpose of the Solvent Extraction System is to purify HEU (impure uranyl nitrate solution from the HE UAl_x alloy dissolution system). This system is made up of the following operations: feed storage; two stages of U extraction, U stripping, solvent conditioning, and U concentration adjustment; raffinate and condensate collection, and product storage.

Impure uranyl nitrate solution is pumped from the UAl_x Accountability Columns to the Feed Columns. Depending on the U concentration the impure uranyl nitrate solution is pumped to the 1st pass extraction subsystem or the 2nd pass extraction subsystem. Both subsystems operate on the same principals:

- Contacting the aqueous uranyl nitrate solution countercurrent with an organic solvent solution (combination of an extractant chemical in a diluent chemical) in a pulsed column to extract the uranium from the impure uranyl nitrate solution.
- Contacting the organic solvent solution laden with uranium countercurrent with an aqueous solution to strip the uranium from the solvent in another pulsed column.

- The aqueous solution (a pure uranyl nitrate solution) is boiled to reduce its volume thereby increasing the uranium concentration.
- The stripped solvent is treated with sodium carbonate and then nitric acid to condition it to be reused in the extraction column.
- Process waste solutions, raffinate from the extraction column and condensate from the boildown unit, are collected, and measured for SNM. If uranium concentration is too high, the solution is recycled to the extraction column; otherwise, the waste solution is pumped to WWTF and treated. Used sodium carbonate, another process waste solution, is collected in a sump and recycled to the extraction column.

The purified uranyl nitrate solution is collected in test columns. After being held in the test column, the solution is moved to the HEU Mix/Measure Columns when needed as feed for the HEU to LEU downblending process.

15.13.5 Downblending Process

The HEU to LEU Downblending Process involves blending HE uranyl nitrate solution with a blendstock (N uranyl nitrate solution) to produce LEU (uranyl nitrate solution) with ^{235}U enrichment of up to 6 wt.%. Adjustments are made to the LE uranyl nitrate as necessary to meet customer requirements. The LE uranyl nitrate is pumped to a hold tank to await release.

The blendstock solution is prepared from N uranium trioxide powder by dissolving it in a tank of nitric acid, the NU Dissolution System.

The HE uranyl nitrate solution is pumped into the HEU Mix/Measure Columns and characterized.

The downblending process begins by pumping characterized HE uranyl nitrate solution into the HEU Feed Columns. Blendstock solution is then pumped from the NU Dissolution System into the Blend Tank. The blendstock solution is then mixed by recirculating the solution from the bottom of the tank to the top of the tank with a pump. A venturi unit in the recycle line pulls the HE uranyl nitrate solution from the HEU Feed Columns into the NU recycle stream. The two solutions then pass through a static mixer to thoroughly combine them prior to the end of the recycle pipe. The solution continues to be recycled from the bottom of the tank to the top of the tank until the HE uranyl nitrate solution has been drawn out of the HEU Feed Columns. U concentration and wt.%^{235}U of the LEU batch are analyzed. If the ^{235}U exceeds 5 wt.% more blendstock solution is added from a small column next to the Blend Tank. Once the U concentration and wt.% ^{235}U are verified, the batch is pumped to the LEU Hold Tank to be characterized.

After the LEU batch is released it is pumped from the LEU Hold Tank in Bldg. 333 to the Uranyl Nitrate Building, Bldg. 510, in the BLEU Complex.

15.13.6 Uranium Recovery Process

HEU contaminated items are placed in a tray dissolver to be rinsed with nitric acid and water to reduce the HEU contamination on the items. The nitric acid solution, with the uranium will be pumped through a filter to the Solvent Extraction Feed Columns.