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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
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
NFS Sanitary Sewer (See Note 8)	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
	Composite/Monthly[9]	Insoluble Radioactivity	> insoluble gross alpha or beta radioactivity in background water	alpha - 3.0E-08 beta - 5.0E-08
BLEU Complex Sanitary Sewer	Continuous/Daily[3]	Gross Alpha Gross Beta	Sample > 3.0E-7 Sample > 6.0E-6	1.5E-08 3.0E-08
	Composite/Monthly	Isotopic U	Sample SOF > 0.5 (see note 4)	1.0E-09
	Composite/Monthly[10]	Insoluble Radioactivity	> insoluble gross alpha or beta radioactivity in background water	Alpha – 3.0E-08 Beta – 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	Sample > 25 pCi/g	5 pCi/g
		See note 5		
Silt/Sediment	Grab/Quarterly	Gross Alpha	Sample >25 pCi/g	5 pCi/g
		See note 5		
Vegetation	Grab/Quarterly	Gross Alpha	Sample >25 pCi/g	5 pCi/g
		See note 5		
Groundwater	Grab/Quarterly	Gross Alpha	Sample > 15 pCi/liter	10 pCi/L
		Gross Beta	Sample > 50 pCi/liter	15 pCi/L
		See note 5		

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.*
8. Sampling is only required for disposal of process water containing licensed materials into the sanitary sewerage in accordance with 10 CFR 20.2003.
9. The compliance sampling location for insoluble radioactivity on this discharge point is the Ground Water Treatment Facility (GWTF), because this is the only stream that discharges radioactive material into the NFS Sanitary Sewer. Insoluble radioactivity sampling is not required on this discharge point when the GWTF is not operational.
10. The compliance sampling location for insoluble radioactivity on this discharge point is the Effluent Processing Building (EPB), because this is the only stream that discharges radioactive material into the BLEU Complex Sanitary Sewer. Insoluble radioactivity sampling is not required on this discharge point when the EPB is not ooperational.

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, except noncontact cooling water, 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.

Sanitary sewer wastes are discharged through two main streams (one for the BLEU Complex and one for the remainder of the main NFS plant site), to the Erwin-POTW. When process water containing radioactive materials is disposed of by release into the sanitary sewerage, in accordance with 10 CFR 20.2003 requirements, samples representative of the total discharge from the applicable sanitary sewer discharge point will be collected and analyzed as outlined in Table 5.1. The monthly composite samples will be analyzed for additional radionuclides, when the concentrations of those radionuclides exceed 10% of the concentration values in 10 CFR 20, Appendix B, Table 2, Column 2. A method published by the American Public Health Association [i.e., 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 the guidance for the insoluble radioactivity analyses.

The sewage sludge at the Erwin-POTW will be sampled quarterly, provided a blow-down sample is available. The sewage sludge samples will be analyzed in accordance with the specifications in Table 5.1.

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 results of the insoluble radioactivity measurements performed on the sanitary sewer samples will be compared to the amount of insoluble radioactivity present in similarly processed background water samples. If insoluble radioactive material is detected in sanitary sewer discharges at concentrations that are statistically greater than the concentrations measured in background samples, discharges of radioactive material to the appropriate sanitary sewer stream will be stopped until appropriate corrective actions are implemented.

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

Radioactivity in liquid effluents are summarized in an internal quarterly liquid effluent report. This report includes information on both the gross alpha and gross beta radioactivity in each liquid effluent stream (i.e., Waste Water Treatment Facility (WWTF), NFS Sanitary Sewer, BLEU Complex Sanitary Sewer, and Banner Spring Branch).

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.

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		15.10.6.4-1 through 15.10.6.4-5	2	06/29/01
		15.10.6.5-1 through 15.10.6.5-6	2	06/29/01
		15.10.6.6-1 through 15.10.6.6-11	3	06/29/01
		15.10.6.7-1 through 15.10.6.7-7	2	06/29/01
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CHAPTER 9

GENERAL INFORMATION

A. General Information

9.1 CORPORATE INFORMATION

Nuclear Fuel Services, Inc., (NFS) has its principal offices in Erwin, Tennessee. Chapter 11 discusses the relationship and responsibilities of the Corporate organization as it relates to safety.

9.2 FINANCIAL QUALIFICATION

As a result of the transfer of ownership of Nuclear Fuel Services, Inc., to NFS Services, Ltd., from Texaco, NFS Services, Ltd., was required to provide details to the Nuclear Regulatory Commission which demonstrate its financial capability to operate and decommission the Erwin facility. The financial arrangements to assure that decommissioning funds will be available are set forth in Chapter 7. A copy of the relevant clause from the NFS/USDOE Contract which states the U. S. Government assumption of liability for decommissioning NFS' facilities is included as Appendix A to this chapter.

9.3 SUMMARY OF OPERATING OBJECTIVE AND PROCESS

Reference Sections 1.4 and 1.5 of Part I, which provide a summary of special nuclear material possession limits and authorized activities.

9.4 SITE DESCRIPTION

Reference Chapter 3 of the Environmental Report (December 1996), which was approved by the NRC concurrently with the license renewal dated July 2, 1999.

Reference Chapter 3 of the Supplemental Environmental Report (November 2001) for a description of the plant expansion to include the BLEU Complex approved by the NRC on July 9, 2002 (Federal Register, Vol. 67, Number 131).

9.5 LOCATION OF BUILDINGS ON SITE

Locations of buildings on the NFS plant site are shown and discussed in Chapter 10, "Facility Description."

9.6 MAPS AND PLOT PLANS

Figures 9.1 and 9.2 show the location of the NFS Plant site in relation to the state, the county, and the general environs.

9.7 LICENSE HISTORY

The license history is shown in Table 9.1.

Figure 9.1

LOCATION MAP OF THE NUCLEAR FUEL SERVICES PLANT
ERWIN, TENNESSEE

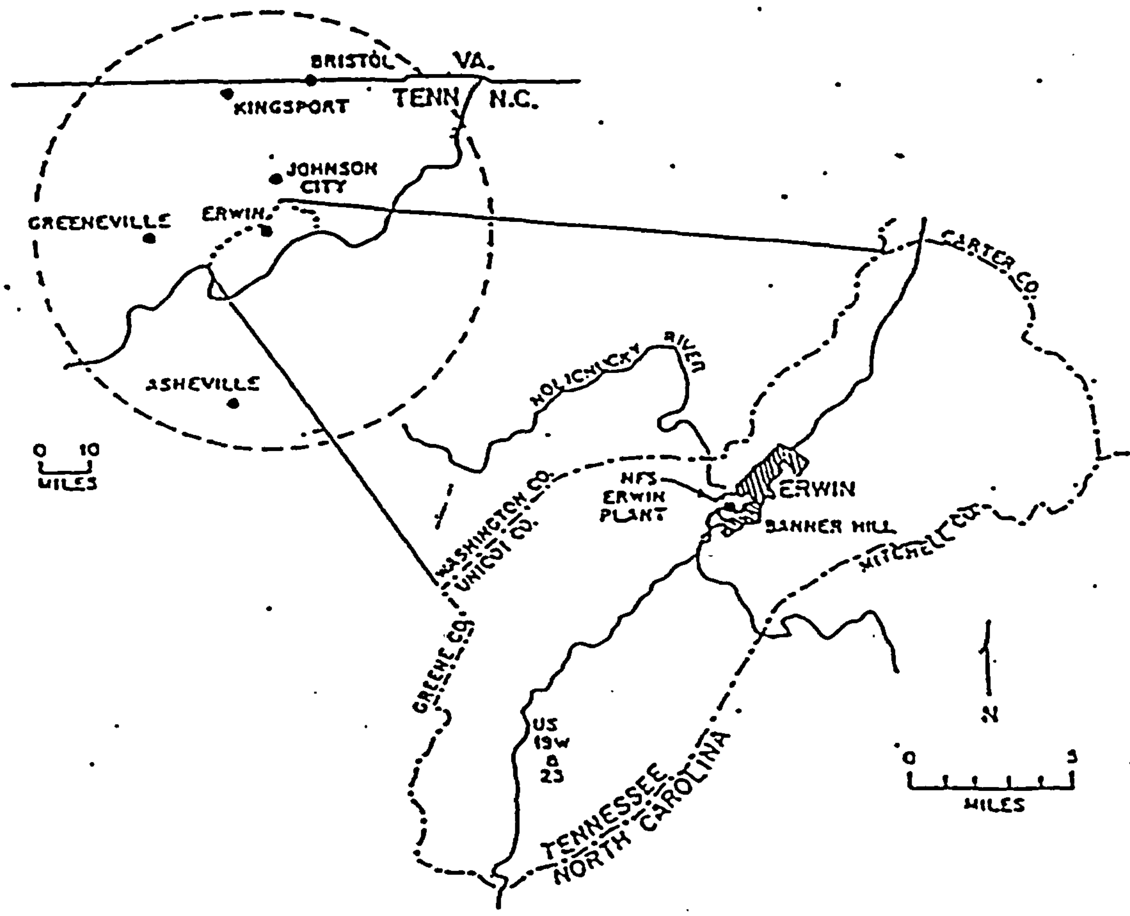


Figure 9.2

PLANT LAYOUT AND PROPERTY BOUNDARIES

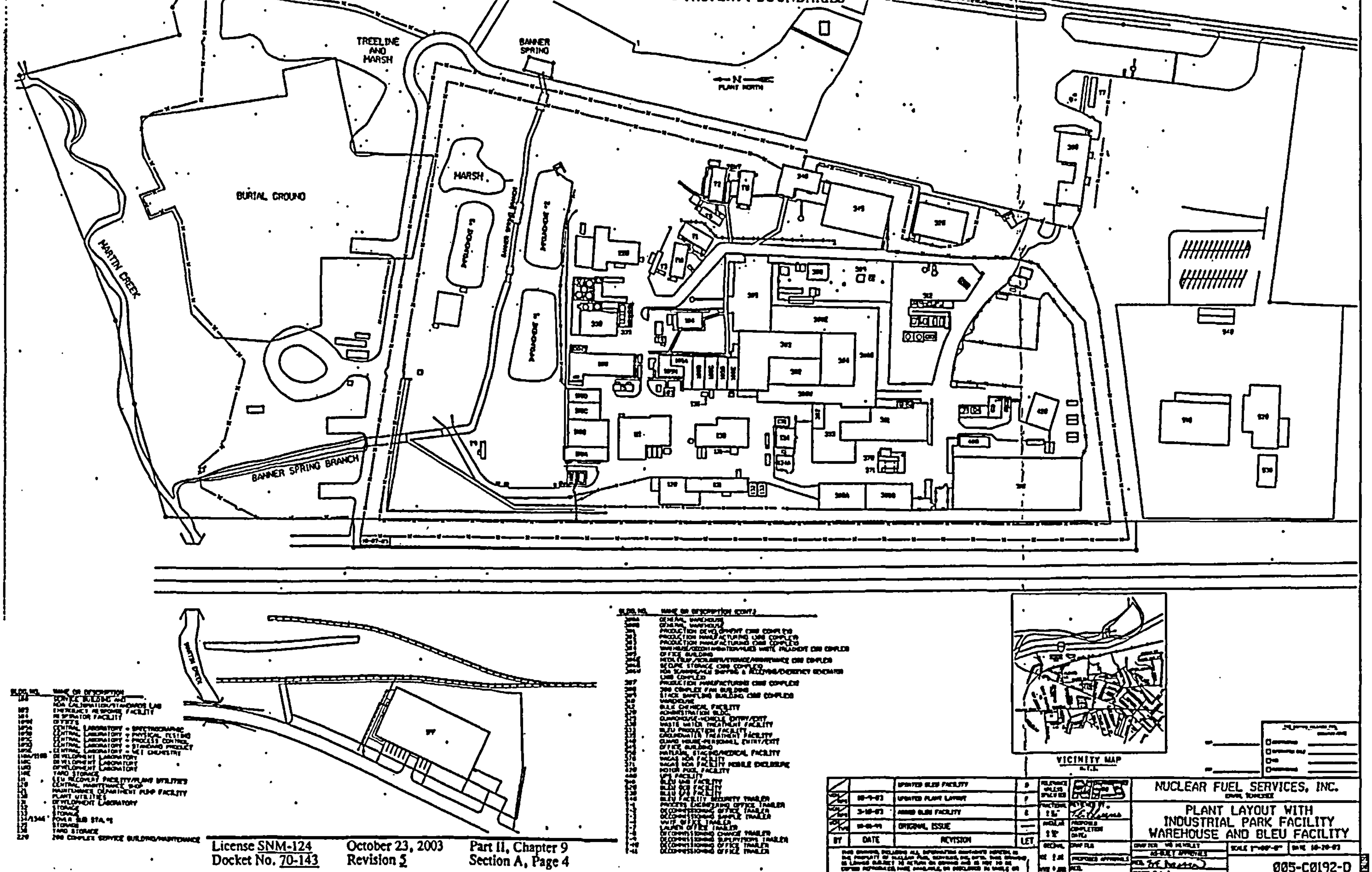


Table 9.1
LICENSE HISTORY

SNM-124 was most recently renewed by the NRC on July 2, 1999. The following amendments have been issued subsequent to that renewal.

Amendment Number	Subject	Effective Date
1	Authorization to Operate KAST Fuel Process Areas 100-900, A-C, and Auxiliary Systems	08/03/1999
2	Authorization to Allow Use of QC Vault and to Delete License Conditions S-6 and S-7	02/04/2000
3	Authorization to Delay Conducting Physical Inventory Pursuant to 10 CFR 70.34	04/03/2000
4	Authorization to Delete License Condition S-13	04/03/2000
5	Authorization to Operate KAST Uranium Recovery Areas D - J	05/05/2000
6	Revisions to the Fundamental Nuclear Material Control Plan	05/16/2000
7	Authorization to Delay Conducting Physical Inventory Pursuant to 10 CFR 70.34	06/02/2000
8	Clarification of Possession Limits for Pu Residual Contamination, Special Air Sampling and Internal Exposure Assessments	06/13/2000
9	Bulk Chemical Storage Tanks Analysis	07/03/2000
10	Authorization to Adjust Annual Limit on Intake (ALI) and Derived Air Concentration (DAC)	08/11/2000
11	Addition of Industrial Park Facility	09/13/2000
12	Authorization to Adjust Liquid Effluent Discharge Limits and NRC Correction of Previous Amendments	10/27/2000

13	Revision to Fundamental Nuclear Material Control Plan and Change to Safeguard Condition SG-4.16	11/30/2000
14	Revision of License Conditions S-39 and S-41	12/13/2000
15	Approval of NFS Site Security Training Plan, Revision 15, Safeguards Contingency Response Plan, Revision 0, and Emergency Plan, Revision 4	12/22/2000
16	Approval of Request for Time Extension to Conduct A Physical Inventory	01/15/2001
17	Revision of License Condition SG-6.1	01/30/2001
18	Revision of License Condition S-28	01/30/2001
19	Revision of License Condition S-25	02/28/2001
20	Amendment to License Condition S-1	03/01/2001
21	Approval of Request for Time Extension to Submit the Physical Inventory Summary Report	03/26/2001
22	Deletion of License Conditions S-43 and S-44	03/26/2001
23	Authorization to Amend License Condition S-41 for Extension of Compensatory Measures from April 30, 2001 to June 30, 2001	04/24/2001
24	Deletion of License Condition S-20 and Review of 04/27/2001 Revised Safety Demonstration (S-27)	04/27/2001
25	Amend License Conditions for Safety Related Equipment	06/04/2001
26	Revision of License Condition S-22	06/04/2001
27	Approval of North Site Decommissioning Plan	06/19/2001
28	Revisions to HEU FNMC Plan, License Condition SG-5.1	06/27/2001

29	Authorization to Extend Safety Condition S-41 to July 31, 2001	06/29/2001
30	Authorization to Extend Deadline for Safety Conditions S-28, S-29, S-31, S-32, S-33, S-34, S-36 and S-37 to November 1, 2001	07/18/2001
31	Approval of ISA Plan and Deletion of License Conditions S-28 through S-38	10/30/2001
32	Deletion of License Conditions S-41 and S-45	02/22/2002
33	Revisions to HEU FNMC Plan, License Condition SG-5.1	03/29/2002
34	Approval of Emergency Plan, Revision 5	05/03/2002
35	Time Extension to Submit the Physical Inventory Summary Report	07-19-2002
36	Revised Fundamental Nuclear Material Control Plan	08-30-2002
37	Revised Appendix A to Chapter 5 of North Site Decommissioning Plan	03-31-2003
38	Source Reduction	05-07-2003

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, 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.

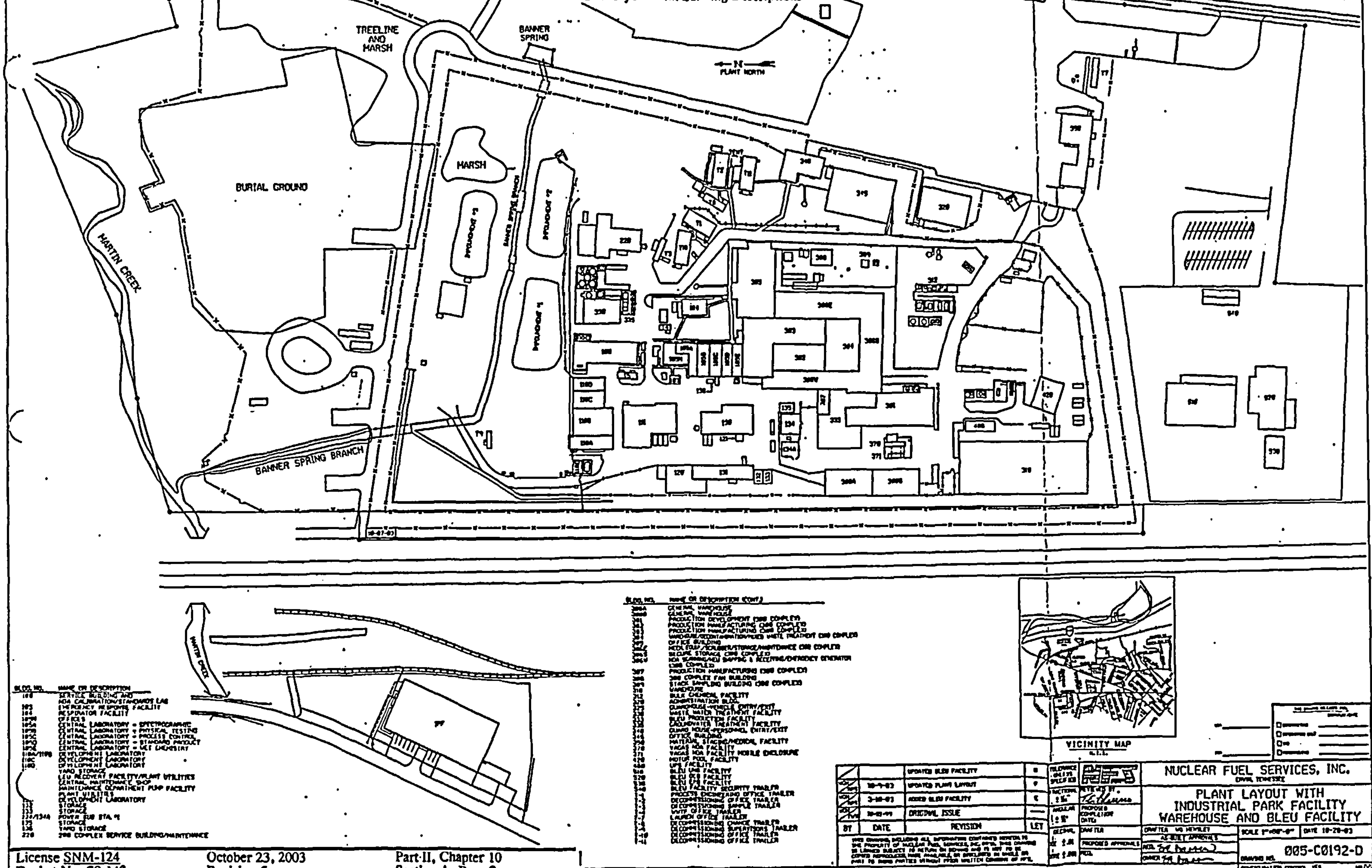
10.1.2 Maintenance Facilities

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



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. Buildings 225, 230 and 233 are currently 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 and Owner Controlled 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. Construction in Building 333 is in process for 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, container cleaning operations, waste compactor, offices, non-nuclear storage warehouse, U-metal conversion pilot process and a mixed waste treatment process. Building 306 contains process chemical tanks, 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 25 storage tanks, 1 receipt tank, and 1 uranyl nitrate tank for 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.

10.1.17 Guard/Security Building (Bldg. 540)

The Guard/Security Building (GDB) contains no radiological controlled material and is strictly a support facility.

10.1.18 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). Building 333 also houses a uranium recovery system. The LE uranyl nitrate solution will be transferred to the Uranyl Nitrate Building after verification that the solution meets the product specifications.

10.19 Oxide Conversion Building (Bldg. 520)

Low-enriched uranyl nitrate liquids stored at the Building 510 are transferred to and converted into uranium oxides at Building 520. In addition, natural uranium oxide will be dissolved in Building 520 and transferred to Building 510 for storage and shipping.

10.20 Effluent Processing Building (Bldg. 530)

Process waste streams generated at the OCB are treated at the Building 530 prior to discharge and/or disposal in accordance with applicable regulator requirements.

CHAPTER 10

B. UTILITIES

10.2 UTILITIES

10.2.1 Electrical

Electrical power is supplied from the Tennessee Valley Authority through Erwin Utilities. Erwin Utilities is municipally owned and operated. Erwin Utilities has an electrical substation approximately one mile northwest of the NFS Site. There is one electrical substation (134 on Figure 10.1) on the NFS site, jointly owned by Erwin Utilities and NFS, served by three-phase 12,500 V transmission lines. There are also Erwin Utilities feeder lines to specific parts of the Site: from the northeast corner of the protected area for perimeter lights, parking lot lights and plant sign; from the east to Building 350 outside of the protected area; from the east (underground) to Buildings 320, 325, and 345; and from the west (underground) to the BLEU Complex.

Electrical power is distributed throughout the Site on cable owned and maintained by Erwin Utilities The cable is primarily run overhead. The distribution to Building 306 is via cable trough. The distribution from Building 306 to Building 308 is underground. The distribution from the BLEU Complex utility transformer to Buildings 510, 520, 530, and 540 is underground.

10.2.1.1 Emergency Electrical Power

Emergency electrical power is available from uninterruptible power supply (UPS) systems located in Buildings 306, 510, and 520. In addition to the UPS systems there are automatic transfer switches (ATS-1 for Bldg. 306 and ATS-UNB and ATS-OCB for BLEU Complex) that detect loss of Erwin Utilities power, send a start signal to diesel engine generators, transfer the load to the generators when an appropriate output voltage has been reached, and transfer back to utility power after Erwin Utilities power has been restored for a predetermined time. The automatic transfer switches then allow the generators to operate for a predetermined cool-down period prior to shutdown. This automatic switchover with UPS provides for continuous criticality detection and other surveillance during the absence of Erwin Utilities power.

Building 306: The Building 306 UPS supplies emergency electrical power to nondestructive assay (NDA) equipment located in Building 100, and the criticality/fire detection and alarm system located in Building 105. The UPS is rated at 150 KVA. The diesel engine generator provides electrical power to the UPS system and to other locations. A manual transfer switch located in Building 130 provides electrical power from the generator to the two steam boilers and associated equipment. The generator produces 175 KW of 3-phase 480 VAC electrical power.

BLEU Complex: The BLEU Complex UPS systems provide power to security, criticality/fire detectors and alarms, and central process control systems. The Building 510 UPS is rated at 12 KVA. The Building 520 UPS is rated at 20 KVA. The diesel engine generator produces 320 KW of 3-phase 480 VAC electrical power.

10.2.1.2 **Re-establishment of Normal Electrical Service**

Utility power is automatically restored upon restoration of utility power via an automatic transfer switch and the uninterrupted power supply. Utility power is manually restored to the blowers and boilers upon restoration of utility power.

10.2.2 Compressed Air

Two air compressors are centrally located within the main plant area, providing a total capacity of 1475 cfm of compressed air at 100 psig. One unit serves as a backup to the other in order to provide a constant supply. Two air compressors are located in the BLEU Complex (one in Building 510 and one in Building 520). The air compressor in Building 510 is rated at 70 cfm at 100 psig. The air compressor in Building 520 is rated at 70 cfm at 100 psig. Air exiting the compressors passes through receiving tanks, prefilters, desiccant air dryers, and after filters prior to distribution.

10.2.3 Water Supply

Water is supplied to the NFS Site from the Erwin Utilities system. Erwin Utilities is municipally owned and operated. The Erwin Utilities system consists of seven storage tanks having a combined storage capacity of 2,113,000 gallons. Three wells and one spring serve the system with a combined low flow generation capacity of 2,300,000 gallons per day. Another spring is available but not currently in use. The line pressure for the portion of the system serving the main plant area has been measured at 100 psig static. At 1400 gallons per minute flowing to the main plant area the residual line pressure is 50 psig. The line pressure for the portion of the system serving the BLEU Complex has been measured at 98 psig static. At 1220 gallons per minute flowing to the BLEU Complex the residual line pressure is 64 psig.

The Erwin Utilities system supplies the NFS Site needs for process water, potable water, and fire protection water. The fire protection water systems at the Site are described in Section 10.5 of this chapter. The emergency backup water supply for these systems is the Erwin Utilities system.

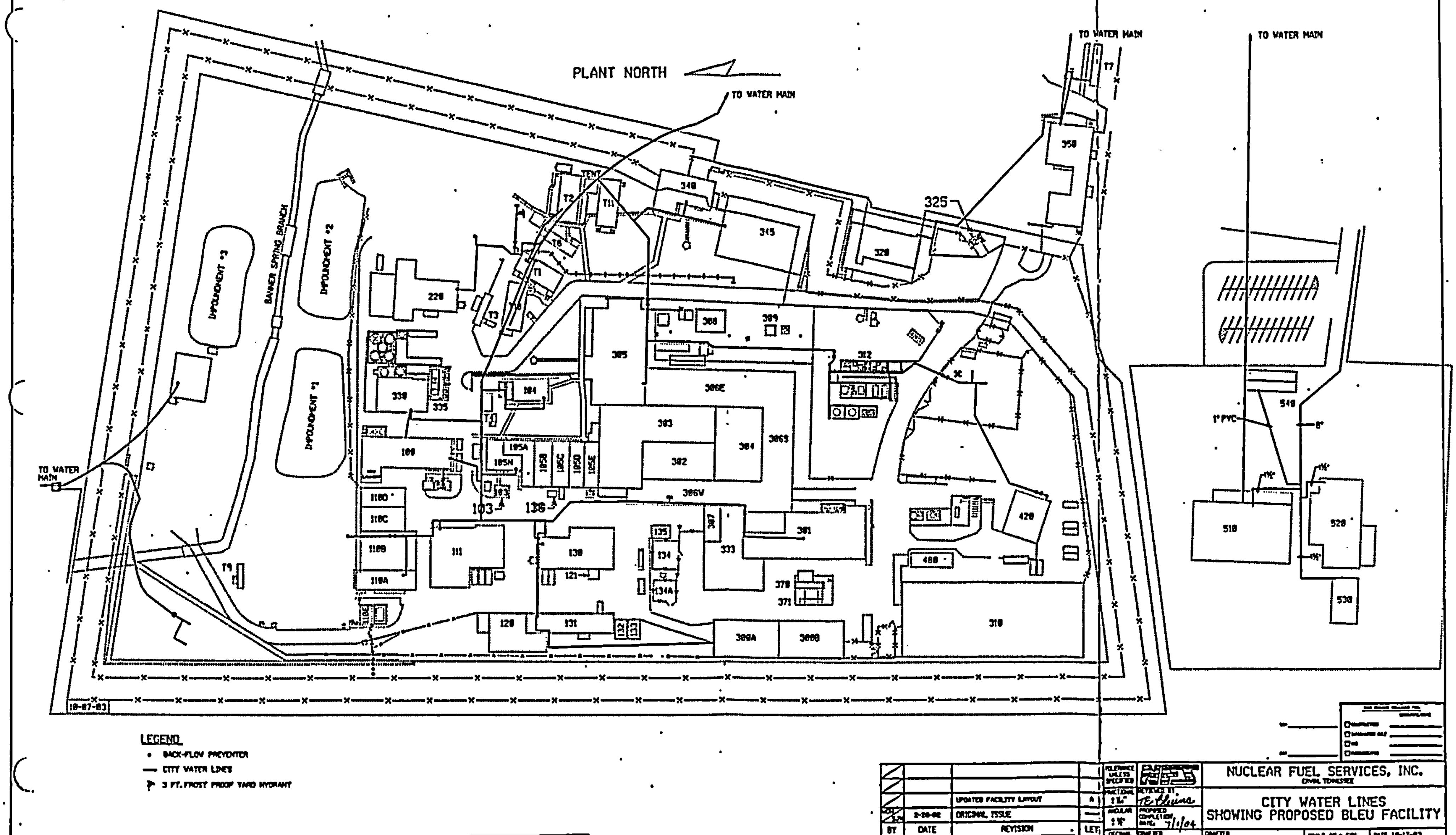
Figure 10.2 is a schematic of the water supply system for the NFS Plant. The nonfire-protection connections to the Erwin Utilities system consist of three four-inch lines and one eight-inch line off the main at Carolina Avenue.

One of the four-inch lines serves Buildings 350, 325, and 320. One of the four-inch lines serves the remainder of the Plant. One of the four-inch lines, entering the north end of the Plant, serves the north site D&D office and change trailers. The eight-inch line serves the BLEU Complex.

At its entrance to each building, in the Plant and to the BLEU Complex, the water supply is separated into two systems (potable water and process water). Potable water is restricted to drinking, sanitary needs, safety showers, and eye washes. Process water supplies process and other facility needs. Reduced pressure back-flow preventers preclude back flow of process water into the potable water system under any condition. The backflow preventers are tested upon installation and yearly thereafter.

Under normal conditions, the average daily water use is 43,000 gallons. Abnormally high usage could occur during activation of the fire protection systems.

Figure 10.2
City Water Lines



CHAPTER 10

C. VENTILATION -- HVAC

10.3 VENTILATION SYSTEMS

10.3.1 <u>General</u>

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 <u>Heating, Ventilation, and Air Conditioning Systems</u>

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 25-30 percent efficient ASHRAE pre-filters followed by 80-85 percent efficient ASHRAE filters. The filtered air is heated or cooled as appropriate for personnel comfort before being diffused into the building.

- 300 Complex

Building	Process Exhaust (CFM)	HVAC Recirculation (CFM)
302	9,400	70,000
303	2,500	75,000
304	2,800	11,500
306-E	1,500	50,700
306-W	4,700*	15,000
306-S (Vault)	0	7,400
302 E Incinerator/302 Storage Cage Area	0	19,000
333	26,000**	51,300

*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 FMF HVAC system is 248,600 CFM. Room air in the amount of 20,900 CFM is drawn into the FMF PEVS and is replaced by fresh air entering the building.

- Vaults (300 Complex)

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. The air handling units for Bldg. 520 on the roof recycle and filter 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	2,000	9,000
520	6,900	29,000
530	200	0

- Building 111

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

CHAPTER 10

G. VENTILATION – OTHER FACILITIES

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.

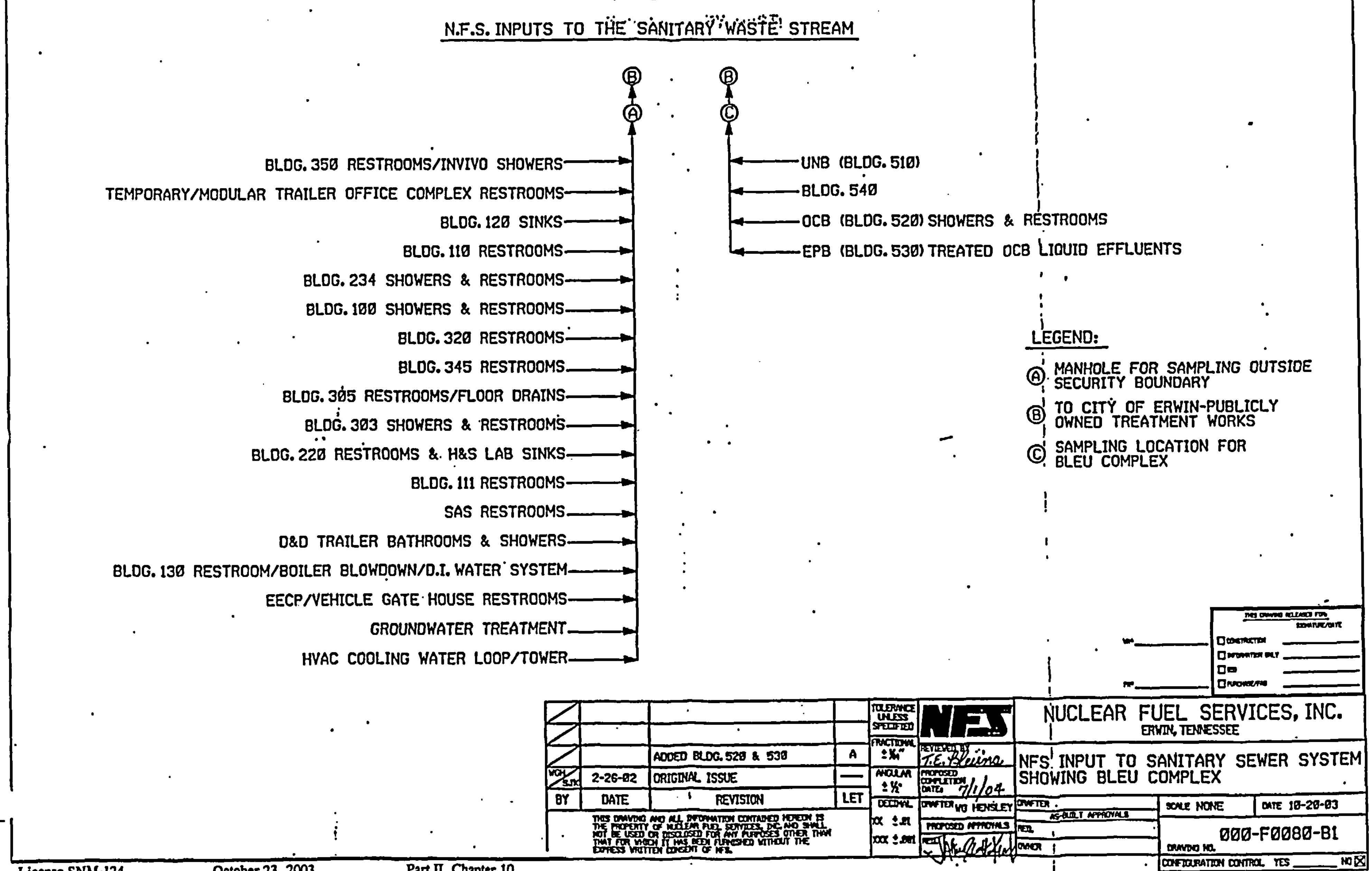
10.3.3.13 **BLEU Complex Oxide Conversion Building, Bldg. 520**

The description of the PEVS in Bldg. 520 is provided in the OCB/EPB ISA Summary.

10.3.3.14 **BLEU Complex Effluent Processing Building, Bldg. 530**

The description of the PEVS in Bldg. 530 is provided in the OCB/EPB ISA Summary.

Figure 10.12


N.F.S. INPUTS TO THE SANITARY WASTE STREAM
BLDG. 350 RESTROOMS/INVIVO SHOWERS
TEMPORARY/MODULAR TRAILER OFFICE COMPLEX RESTROOMS
BLDG. 120 SINKS
BLDG. 110 RESTROOMS
BLDG. 234 SHOWERS & RESTROOMS
BLDG. 100 SHOWERS & RESTROOMS
BLDG. 320 RESTROOMS
BLDG. 345 RESTROOMS
BLDG. 305 RESTROOMS/FLOOR DRAINS
BLDG. 303 SHOWERS & RESTROOMS
BLDG. 220 RESTROOMS & H&S LAB SINKS
BLDG. 111 RESTROOMS
SAS RESTROOMS
D&D TRAILER BATHROOMS & SHOWERS
BLDG. 130 RESTROOM/BOILER BLOWDOWN/D.I. WATER SYSTEM
EECP/VEHICLE GATE HOUSE RESTROOMS
GROUNDWATER TREATMENT
HVAC COOLING WATER LOOP/TOWER
UNB (BLDG. 510)
BLDG. 540
OCB (BLDG. 520) SHOWERS & RESTROOMS
EPB (BLDG. 530) TREATED OCB LIQUID EFFLUENTS
LEGEND:
Ⓐ MANHOLE FOR SAMPLING OUTSIDE SECURITY BOUNDARY
Ⓑ TO CITY OF ERWIN-PUBLICLY OWNED TREATMENT WORKS
Ⓒ SAMPLING LOCATION FOR BLEU COMPLEX
NUCLEAR FUEL SERVICES, INC.
ERWIN, TENNESSEE
NFS INPUT TO SANITARY SEWER SYSTEM SHOWING BLEU COMPLEX
ADDED BLDG. 520 & 530
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ORIGINAL ISSUE
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ANGULAR ± 1/2°
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SCALE NONE
DATE 10-20-03
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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: 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 8-inch connections to the City of Erwin Water Distribution System. Additionally, there are two dead-ended feeds. One is a 6-inch supply and the other is an 8-inch supply. Both of these are also connected to the City of Erwin Water Distribution System. Two connections are arranged in a standard pit (underground vault) with a single check valve and an isolation valve. Two other connections are arranged in an above-ground, heated vault with a double backflow preventer and double isolation valves.

Figure 10.13 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 10.11). 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. Hose houses are not provided in the area of Bldgs. 510, 520, 530, and 540.

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 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**

Portable fire extinguishers are located 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. The central alarm panel for the BLEU Complex is located in the Electrical Room of Bldg. 510. It also remotely reports to the Guard Station in Bldg. 540.

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 Brigade personnel do not respond to Bldgs. 510, 520, 530, and 540. Fire response to the BLEU Complex is solely provided by the City of Erwin Fire Dept.

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 10.13
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	
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	
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	
510	X					Complete Coverage with exception of electrical room	

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.
303		X	X		Beam detection for general area, linear detection cable in selected areas.
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
510	X		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 NFPA 801, "Standard for Fire Protection for Facilities Handling Radioactive Materials." 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. 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 12

B. INSTRUMENTATION

12.6 INSTRUMENTATION

12.6.1 General

An adequate number of radiation detection instruments is available to ensure that proper radiation surveys can be performed. Selection criteria for portable and laboratory counting equipment are based on the types of radiation detected, maintenance requirements, ruggedness, interchangeability, and the upper and lower limits of detection. The radiation safety and protection function reviews the types of instruments being used for each monitoring function and makes appropriate recommendations based upon regular input and ongoing evaluation.

12.6.2 Instrument Types

Table 12.2 details the radiation detection instruments employed at NFS. It must be noted that while representative, the list is not all inclusive.

Furthermore, upon industry development, the instruments may be upgraded or replaced with other equipment having comparable or superior operating characteristics.

12.6.3 Equipment Storage, Maintenance, and Calibration

Radiation detection equipment is stored and made available for routine use at various Plant locations, such as the radiation monitoring laboratories, controlled zone exits, change rooms, and other designated locations. Additional emergency equipment is stored and made available in designated site emergency locations as specified in the Radiological Contingency Plan and the implementing procedures developed in support of the plan.

Maintenance and calibration are provided at specified frequencies in several dedicated facilities including electronics engineering, maintenance function, and safety function. These services may also be provided by offsite vendor contracts.

Table 12.2
TYPICAL RADIATION DETECTION INSTRUMENTS/SYSTEMS USED AT NFS

Fixed Installation Equipment	Model
Criticality warning system (ionization chamber and GM type)	Victoreen remote gamma sensing system, Eberline RMS
Continuous Air Monitors	Alpha 6, Canberra Alpha Sentry
In vivo lung counter (Canberra Industries)	Canberra Industries Custom System
Portable Instrumentation	
Alpha surveys (scintillation type probe)	Ludlum 3 , 4, 2221 or 2224 with either 43-5 or 43-90 probes
Alpha personnel monitoring (scintillation and gas-flow proportional type probes)	Eberline RM-19, Eberline RM-25, or Eberline RM-20, either with Eberline AC-3 probe, Aptec Alpha-7 Hand and Foot Monitor, Ludlum Medel 177 with 43-5 probe
Betta Personnel Monitoring	Eberline RM-14, 19, or 25 with BM pancake probes
Beta-Gamma Applications	
GM-type counter	Eberline E-520, Ludlum 78, Ludlum 3 with 44-38 probe
Beta/Gamma (GM type)	Ludlum 3 with 44-9 probe
Beta/Gamma (ionization type)	Eberline RO-2, RO-2A, or RO-20, Ludlum Model 9
Gamma	Eberline Pic-6A or Pic-6B
Neutron	NRD Sphere, Eberline ESP2e, Ludlum 12-4
Gamma (scintillation probe)	Ludlum 2350 with NI detector
Laboratory Instrumentation	
Automatic low background alpha/beta proportional counting system	Tennelec LB 5100, Protean WPC-9550, Tennelec LB-4100
Manual alpha/beta counting system	Eberline SAC-4, Ludlum 2929, Eberline Hand E Count

12.6.4 Criticality Detection System

The NFS criticality detection system complies with the requirements of Regulatory Guide 8.12. Monitoring is performed with Victoreen ionization chamber and/or GM detector systems, Eberline .

The criticality detection system consists of only two essential parts: the readout module and the detector. The detector collects a charge caused by incident radiation. This charge is then conditioned and transmitted via multiconductor cable and displayed on the readout meter.

A calibration check is performed on a semi-annual basis. In addition, at least one detector pair will be response tested monthly on a rotating basis. Periodically, the alarm is sounded for familiarity, training or drills.

To meet regulatory requirements in 10 CFR Part 70.24 and to assure a limited number of false alarms, the system is set up with two detectors on each circuit. With this setup, a single failure will not cause alarm actuation. Alarm actuation is caused by either both detectors alarming, a single failure and the second detector alarming, or both detectors failing.

The detectors are presently located as shown on Figure 12.1. Detector locations and system configuration are subject to modification as necessary to maintain adequacy of coverage. This determination is made by the Safety Department.

The placement of criticality detectors is such that all areas of the plant where monitoring is required will be covered. Typically, the alarm trip point is set at 20 mR/hr. This trip point allows for minimization of an alarm from sources other than criticality. When the alarm trip point has been reached or exceeded, the system will produce an alarm throughout the plant which will continue regardless of the radiation level until manually reset. The alarm controls have limited access. Manual initiation of the alarm is provided for testing. A warning signal is generated at the central control unit in the event of a system malfunction. Provisions are incorporated into the alarm system to allow appropriate testing and remote readouts are present at manned posts that will alert personnel in the event of component failure.

Figure 12.1

Criticality Detector Locations

The system is demonstrated to respond to a minimum criticality accident of concern. A criticality accident producing an absorbed dose in air of 20 rads at 2 meters within one minute, is the limiting accident considered for the demonstration of the system response.

The compliance of the system is demonstrated by accounting for shielding from plant materials between a postulated accident and the detectors, as well as distance. The accident is evaluated from a number of locations to demonstrate the possible effects of attenuation. Common modeling codes are used to perform the evaluations such as Microshield and MCNP. Compliance is demonstrated if modeling results indicate that the postulated minimum accident of concern will result in an exposure rate exceeding the alarm set-point at a detector location.

CHAPTER 12

E. EXPOSURE CONTROL

12.14 SURFACE CONTAMINATION CONTROL PROGRAM

12.14.1 General

The NFS surface contamination control program requires that administrative action guidelines be established to assure that contamination levels and employee exposures are kept as low as reasonably achievable (ALARA) and within the limits established by internal action guides.

To comply with these limits, NFS has a protective clothing program and a program for monitoring area contamination levels and personnel contamination.

12.14.2 Area Classification

Classification of the areas and the limits applied to areas within the Plant protected area is based on the use to which the specific area is committed and the potential hazard presented by the presence of surface contamination, particularly with regard to inhalation and resuspension propensity. The area designations are "uncontrolled" and "controlled", and are defined in Chapter 1. Controlled areas may be further subdivided into contamination areas, buffer zones, step off pads, etc., where appropriate. Typical areas within buildings where "controlled areas" are frequently established are presented in Figure 12.2.

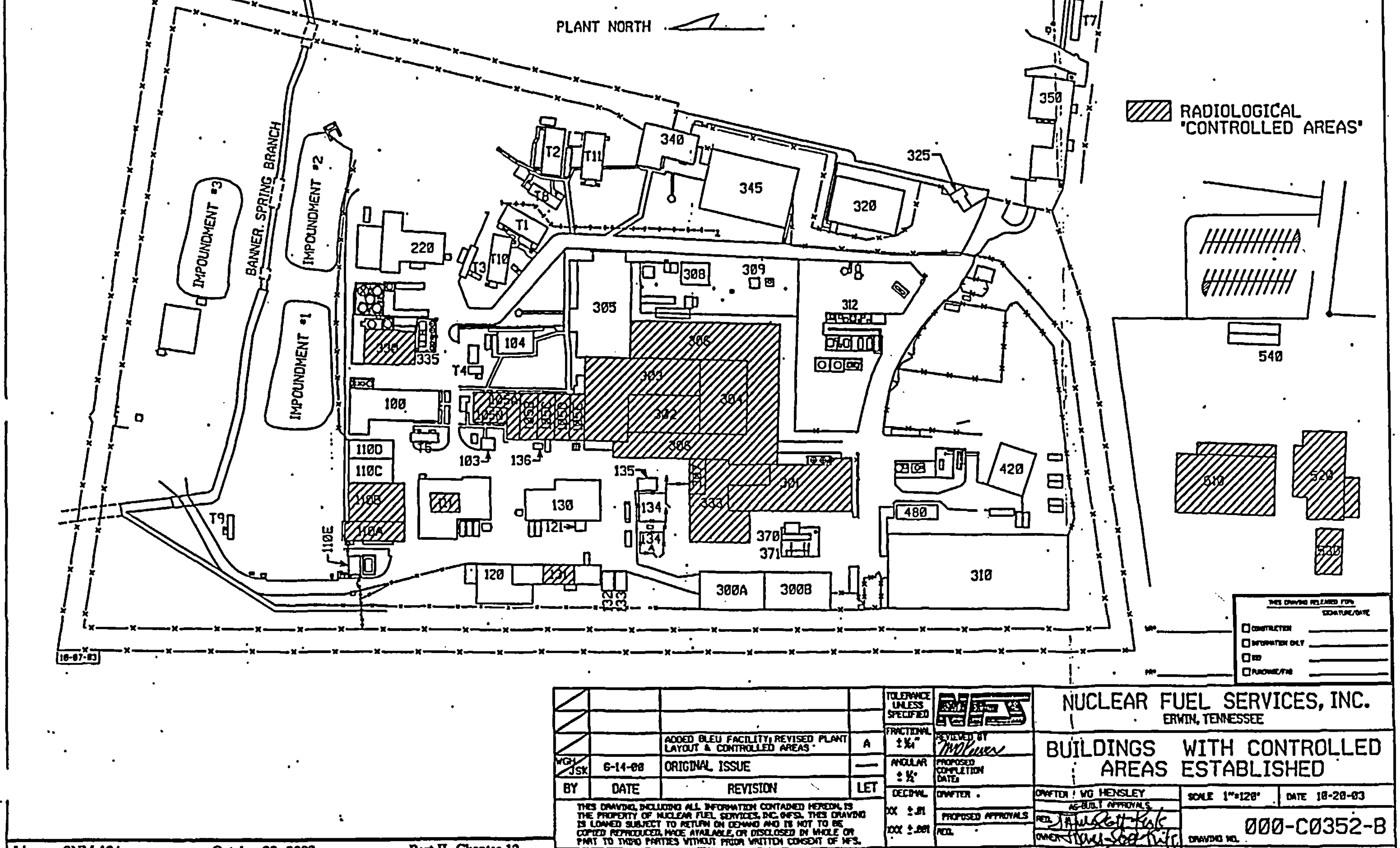
12.14.3 Action Guide Levels

Action guides are established to ensure appropriate corrective actions are taken for contamination control. The guideline levels are designed to be conservative in nature and are not to be regarded as the borderline between "safe" and "unsafe."

If contamination in excess of the action guide levels occurs, the necessary remedial action (decontamination, stabilization, excavation, disposal, etc.) is based upon the particular circumstances and the behavior of the material involved.

Action levels are given in Table 12.6. Response is based on the need to avoid transfer of contamination to uncontrolled areas and to maintain exposures as low as is reasonably achievable. Timeliness of the response is based on the above considerations and is set by internal guidelines.

Figure 12.2
Plant Areas Designated



All areas are required to be surveyed for total and removable alpha and/or beta contamination on routine frequencies. Areas in which the potential for surface contamination is high, or the probability for human uptake is high, are surveyed more frequently.

Table 12.6 CONTAMINATION SURVEY ACTION POINTS		
Location	Transferable Alpha Contamination (dpm/100 sq cm)	Transferable Beta Contamination (dpm/100 sq cm)
Uncontrolled Area	200	1,000
Uranium Controlled Area	5,000	50,000
Plutonium Controlled Area	1,000	N/A

Surface contamination on offsite shipments of radioactive materials complies with Department of Transportation (or other regulatory agency) requirements.

12.14.4 Survey Practices

Removable radioactive contamination is determined by taking a smear from a known surface area (normally 100 cm^2) by applying moderate pressure and assessing the amount of radioactive material on the smear with an appropriate instrument of known efficiency. Wet smears may be taken as necessary and dried appropriately for analysis. In determining removable contamination on objects of lesser surface area, the pertinent levels are reduced proportionally; and the entire surface is wiped. Large area wipes may also be used for onsite release or gross indicators of contamination on an object or in an area.

Measurements of total alpha/beta contamination may be made as a part of the contamination control program. Actions are taken based on the results of the transferrable contamination levels.

The interior surfaces of containment systems such as ventilated hoods, gloveboxes, cells, etc., are excluded from the limits for removable contamination in controlled areas and, therefore, are not routinely surveyed. Special diked areas, drip pans, and the like, although open to room air, are limited to traffic access and, therefore, create less potential for transfer or resuspension.

These areas are surveyed routinely for removable contamination with acceptable levels, and decontamination actions and survey frequencies are set by internal guidelines.

Only alpha contamination surveys are performed routinely. Beta contamination surveys are performed only under special circumstances when the conditions warrant such surveys. Removable and total contamination surveys are performed on the basis of process operations and the contamination trends. Decontamination is performed in accordance with the action points designated in Table 12.6. Measurements are recorded in units of dpm per area of surface surveyed or dpm per wipe for large area wipes.

12.14.5 Control Practices

The contamination buildup within controlled areas is primarily controlled by physical containment of materials in station enclosures. Frequent mopping of floors and wiping down of equipment, ducts, pipes, etc., are used as an additional control measure.

During or at the conclusion of each contamination survey, the foreman or supervisor is advised by the surveyor of all areas which exceed the action limits. The foreman then initiates action to assure timely decontamination. Such action is documented on the survey form.

Each day (Monday through Friday, except holidays) a qualified member of the radiation safety and protection function reviews the contamination surveys for trends, problem areas, timely decontamination, etc. He/she identifies to the area manager those locations considered to be a problem.

A monthly summary of surface contamination results is prepared, reviewed by the manager of the radiation safety and protection function and distributed to Plant management.

12.14.6 Personnel Contamination Control Guidance

To prevent the spread of contamination from the controlled areas and to minimize exposure to employees, the following requirements are enforced:

- All personnel wear anti-contamination clothing while in controlled areas. This may include coveralls, gloves, hoods, shoe covers, or booties, as appropriate.

- All personnel remove protective clothing at the designated boundary and deposit them in the dirty laundry or disposal receptacles.

- All personnel survey for contamination at designated locations after exiting the controlled areas. If the levels in Table 12.7 are exceeded, decontamination is performed. If protective clothing is suspected of being contaminated, the affected areas are also monitored. Actions specified in Table 12.7 are taken.

- Hands and feet are surveyed at a minimum. Additional body or clothing locations are surveyed based on initiating actions (e.g., area contacted liquid or contaminated equipment). Guidance for determining initiating actions and necessary survey(s) are specified in Health and Safety Procedures.

- Periodic overcheck surveys are performed at various locations and documented to assure that, upon leaving the Plant protected area, contamination of personnel does not exceed instrument detection levels.

12.14.7 Contamination Control for Release of Material or Equipment and for Shipping

Surface contamination surveys are conducted for contamination prior to release of potentially contaminated packages, equipment, scrap, or waste from controlled to uncontrolled areas and use. No equipment or package brought from a controlled area is removed from the NFS Erwin facility unless radioactivity contamination levels are at or below the guidelines given in Chapter 1, Appendix A.

Shipments of radioactive materials meet Department of Transportation regulations regarding radiation and contamination levels.

If contamination is detected or is known to have been covered, a reasonable effort is made to eliminate the contamination; i.e., decontamination procedures are repeated until additional effort does not significantly reduce the contamination levels. If the value of the item does not justify this level of effort, it is disposed of as radioactive waste or limited to use within the controlled area. If the value of the item or the need to remove the item from the controlled area is very great, then a conditional release is granted under very strict control conditions designed to prevent the spread of contamination or the exposure of personnel. These conditions are set by internal guidelines.

Table 12.7

PERSONNEL SURVEY ACTIONS/LIMITS

Range/Limit* (dpm/100 cm²)	Skin	Personal Clothing	Personal Shoes	Protective Clothing
0 - MDA	No action	No action	No action	No action
>MDA - 2500	Decontaminate and resurvey. Notify foreman if decontamination is not successful	Decontaminate and resurvey. Notify Safety Department if decontamination is not successful and change into clean clothing	Decontaminate and resurvey. Notify Safety Department if decontamination is not successful and change into clean shoes	Deposit in dirty laundry container.
>2500	Notify area foreman. Decontaminate and resurvey. Notify Safety Department if decontamination is not successful	Decontaminate and resurvey. Notify Safety Department if decontamination is not successful and change into clean clothing	Notify Safety Department. Decontaminate and resurvey. Notify Safety Department if decontamination is not successful and change into clean shoes	Notify Safety Department. Deposit in dirty laundry container.

*Corrected for background. This measurement is for total alpha contamination. A correction will be made for active surface area of the probe used. MDA is defined in Part 1, Chapter 3, Table 3.1.

12.15 URANIUM CHEMICAL TOXICITY

When individuals may have been exposed to soluble compounds (Class D) of uranium enriched to less than 5 wt.% ^{235}U, the chemical toxicity limit of 10 milligrams inhaled in any 40-hour period may be more restrictive than the radiological limit. If this type of exposure is possible, the action levels in Table 12.3 are modified as follows:

Internal Exposure	Action
Airborne - Any result which shows a potential exposure > 0.2 mg U/m³ averaged over a calendar week	Initiate confirmatory bioassay; determine individuals potentially exposed and evaluate work history for total intake; and investigate as to cause and recommend corrective actions. Establish work restriction pending intake assessment; perform detailed exposure evaluation utilizing urinalysis.
URINALYSIS - Any result which shows a potential exposure >10 mg U in a calendar week	Initiate confirmatory bioassay; determine individuals potentially exposed and evaluate work history for total intake; and investigate as to cause and recommend corrective actions. Establish work restriction pending intake assessment; perform detailed exposure evaluation.

NOTE: 0.2 mg U/m³ (Class D) = 10 DAC-hour (1% LEU)
= 15 DAC-hour (2% LEU)
= 20 DAC-hour (3% LEU)
= 26 DAC-hour (4% LEU)
= 31 DAC-hour (5% LEU)

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 2002 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 NFS and BLEU Complex Sanitary Sewers continuously discharge to the City of Erwin – Publicly Owned Treatment Works (POTW), and each sanitary sewer's discharge point is sampled continuously using a proportional sampler. All sanitary sewer samples are collected and analyzed in accordance with the specifications of Table 5.1 in Chapter 5.

Radioactive material may be discharged under 10 CFR 20.2003 regulations to the NFS Sanitary Sewer from the Groundwater Treatment Facility (GWTF) and to the BLEU Complex Sanitary Sewer from the Effluent Processing Building (EPB). When operating, grab samples of the GWTF and EPB liquid effluents are collected. The grab samples are composited monthly, for each discharge stream, and analyzed for insoluble radioactivity. The grab samples from the EPB's batch discharges are also analyzed for gross alpha and beta radioactivity prior to discharging each batch into the BLEU Complex Sanitary Sewer. When gross alpha or gross beta radioactivity results from a grab sample of the EPB's effluent batch exceed an action level, the batch will not be discharged until the elevated concentrations are lowered to acceptable levels.

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

Environmental dosimeters are at onsite and offsite locations to monitor ambient external doses and to assist with the assessment of potential accidents. Environmental dosimeter data are used to monitor external dose rates in unrestricted areas, determine doses to members of the public, and demonstrate compliance with regulatory dose limits. Doses to members of the public will be calculated per 10 CFR 20.1302(b)(1), and may include considerations for the amount of time a member of the public is actually present at or the amount of time a member of the public may be present at a given location.

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. 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
1st Qtr. 2002	0.012	0.11	Bone Surfaces	NNE	250
2nd Qtr. 2002	0.007	0.05	Lung	NNE	250
3rd Qtr. 2002	0.009	0.07	Bone Surfaces	NNE	250
4th Qtr. 2002	0.005	0.04	Bone Surfaces	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
ROUTINE 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	NE Perimeter Air #1 Sampling Sta #173	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 104A, 105A, 106A, Quarterly Downgradient Wells	E Perimeter Air #1 Sampling Sta #174		Nolichucky River Upstream Sampling Point (sediment)
Nolichucky River Downstream Sampling Point		E Perimeter Air #2 Sampling Sta #218		Nolichucky River Downstream Sampling Point (sediment)
		NE Perimeter Air #2 Sampling Sta #217		Martin Creek at Upstream Sampling Point (sediment)
	Other[3]	Near Ponds 1 & 2 Air Sampling Sta #555		Martin Creek at Downstream Sampling Point #1 (sediment)
				Martin Creek at Downstream Sampling Point #2 (sediment)
		W Perimeter Air Sampling Sta #668		Banner Spring at Upstream Sampling Point (sediment)
		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:

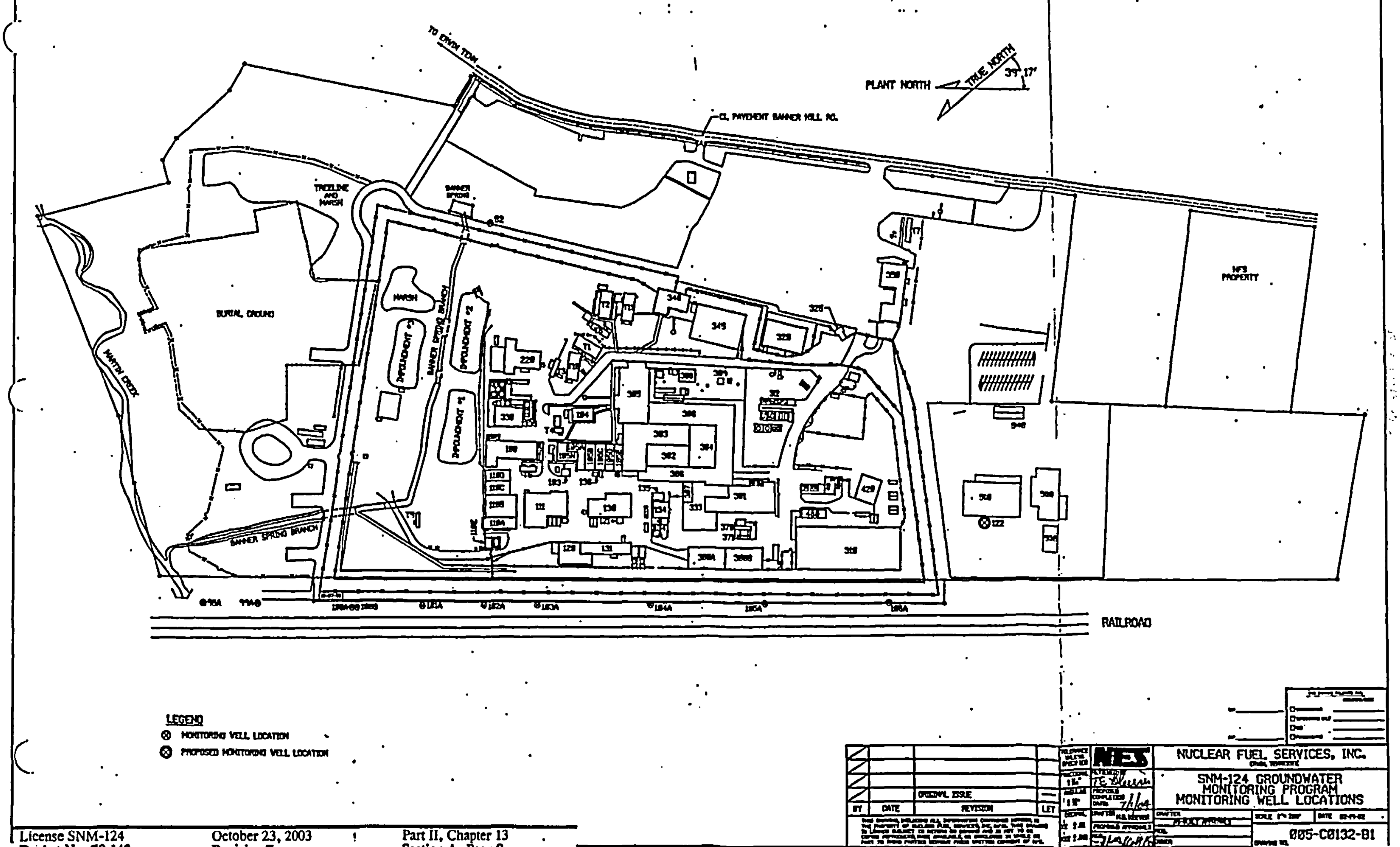
(1) Samples are collected using a continuous, proportional sampler. In the event that this sampler becomes inoperable due to power failure, mechanical breakage, etc., a daily grab sample will be collected.
(2) Wells LD1A and LD2A are routinely collected when the underground storage tanks are in use.
(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	
Stack 234, Building 234	NFS Sanitary Sewer
Stack 327, Building 330	BLEU Complex Sanitary Sewer
Stack 332, Building 120	EPOTW Sludge
Stack 376, Building 301	
Stack 421, Building 100	
Stack 503, Building 530	
Stack 504, Building 520	
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 307	
Stack 704, Building 307	
Stack 510, Building 510	

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



15.14 OXIDE CONVERSION BUILDING – BUILDING 520

Inside the Oxide Conversion Building (OCB) low enriched uranyl nitrate (LE UN) solutions, up to 5 weight $\%^{235}U$, from the Uranyl Nitrate Building (UNB) and LE UN recycle streams, up to 5 weight $\%^{235}U$, from within the OCB are mixed together and then combined with ammonium hydroxide solution in a precipitator system. The precipitate, ammonium diuranate (ADU), is separated by a centrifuge and then processed in a dryer and calciner to uranium dioxide, UO_2. A portion of the UO_2 is diverted to an oxidizer to be processed to triuranium octaoxide, U_3O_8. Batches of UO_2 and U_3O_8 are collected and mixed in a blender to make a homogenous mix of UO_2 and U_3O_8 before the uranium oxide powder is loaded into shipping pails. The pails are placed in Type B shipping packages and transported by truck to another licensed plant.

The processes inside the OCB include: LEU Feed Batch Make Up, LEU Precipitation, LEU Oxide Production, and LEU Recovery. The location of Bldg. 520 is shown in Chapter 10, Figure10.1.

15.14.1 Safety Considerations

The document, *Integrated Safety Analysis Summary Blended Low Enriched Uranium Project Oxide Conversion and Effluent Processing Buildings*, contains discussions of the criticality safety, radiological safety, chemical safety, fire safety and environmental safety bases for the processes in the OCB. Therefore, the information provided in the section (Section 15.14) is limited to brief descriptions of each of the OCB processes.

15.14.2 LEU Feed Batch Make Up

LE UN solution is pumped from the UNB storage tanks to a blend tank inside the OCB. If there is any LE UN recycle solution from LEU Recovery available, it is also added to the blend tank. After the LE UN solution is mixed it is fed to a precipitator system.

15.14.3 LEU Precipitation

The LE UN solution in the feed tank is heated by recirculating the solution through a heater back into the feed tank. The LE UN solution in the feed tank is heated, which improves uranium precipitate separation later in a centrifuge.

The LE UN solution is pumped to a precipitation tank. The LE UN solution enters the precipitation tank through a spray nozzle. Ammonium hydroxide solution, heated by an in-line heater, enters the precipitation tank. The two solutions mix in this tank and a uranium precipitate, ammonium diuranate (ADU), is formed. The ADU slurry is continuously recirculated by a pump through a spray nozzle at the top of the tank. Monitoring the pH of the ADU slurry in the slurry recirculation loop controls the ammonium hydroxide solution flow into the precipitation tank. Periodically dilute nitric acid solution is introduced to the precipitation tank to flush out accumulated ADU solids.

The ADU slurry is pumped to a centrifuge feed tank. The centrifuge feed tank also receives concentrate from the cross-flow filter in the LEU Recovery system and recycle centrate solution from centrate receiver tanks. Ammonium hydroxide solution is added to the centrifuge feed tank to raise the ADU slurry pH to increase separation of the uranium precipitate in the centrifuge.

The ADU slurry is introduced into the center of a rotating centrifuge that forces the ADU solids to the inside wall of the vessel. An internal screw moves the ADU solids to one end of the vessel concentrating and dewatering the solids. A weir inside the centrifuge allows the liquid (centrate) to decant essentially free of ADU solids. The centrate is routed to a set of centrate receiver tanks. The ADU solids fall by gravity into an auger that moves them to a dryer. Periodically the centrifuge can be flushed with either dilute nitric acid or deionized water for cleanout.

15.14.4 LEU Oxide Production

The ADU solids fall by gravity from the end of the auger from the centrifuge into a dryer. The dryer contains paddles that move the ADU solids from the inlet to the outlet while contacting heated surfaces. The dryer reduces the moisture content of the ADU solids. Nitrogen flowing into the dryer sweeps the moisture evolving from the ADU solids out of the dryer. The temperature of the dried ADU solids is monitored to control the heater for the dryer. The ADU solids leave the dryer, pass into a chute and through a rotary valve. The rotary valve isolates the atmosphere in the dryer from the next piece of process equipment.

A calciner, a rotary kiln, operates with a reducing, negative atmosphere at a temperature sufficient to convert the ADU to UO_2. The calciner has three heating zones. Thermocouples measure the temperature at the surface of the calciner tube and control the heating elements for each zone. The dried ADU solids exit the chute from the dryer to a feeder screw that moves the ADU solids into the calciner. Hydrogen (a reducing agent) flows over the LE uranium solids in the calciner. Nitrogen acts as a diluent gas. In the first zone of the calciner the remainder of the moisture in the ADU solids is removed. In the next zones an reaction takes place and the ADU is converted to UO_2.

The UO_2 from the calciner is routed to a solids blender feed hopper. Batches of powder are collected in the hopper and then added to the solids blender where they are mixed together to make a homogenous uranium oxide powder. The uranium oxide powder is loaded into shipping pails at a station below the blender.

15.14.5 LEU Recovery

The centrate is pumped from the centrate receiver tanks to a uranium recovery system. The uranium recovery system in the OCB consists of a filter and an ion exchange resin column to remove uranium from the centrate solution from the centrifuge. The filter removes the insoluble uranium. The ion exchange resin removes soluble uranium. Both are used to return uranium to the process. From the bottom of the ion exchange column the solution is then pumped to the adjacent Effluent Processing Building (EPB).

Miscellaneous tanks in this process area are used to store acid wash solutions, cleaned up uranium solution spills, and other uranium-bearing solutions to return the LEU to the process.

Off-specification LE uranium oxide powder is recycled to the process by three different methods. (1) Add the off-specification LE uranium oxide powder to a two-stage dissolution system. Nitric acid is combined with the LE uranium oxide to make LE UN solution. This LE UN solution is added to a receiver tank and then pumped as needed to the blend tank to be combined with LE UN solution from the UNB. (2) Add the off-specification LE uranium oxide powder back to the solids blender. (3) Add the off-specification LE uranium oxide powder to the calciner.

15.15 EFFLUENT PROCESSING BUILDING – BUILDING 530

The liquid stream exiting the LEU Recovery System in the Oxide Conversion Building (OCB) enters the Effluent Processing Building (EPB) where ammonia is recovered for reuse in the OCB using an ammonia stripping column. The liquid waste from this system is pumped to an evaporator to boil off water. The concentrated liquid waste is then solidified using clay and cement in bulk bags. The bulk bags are then shipped to a licensed low-level radioactive waste disposal facility in accordance with applicable regulatory requirements.

The processes inside the EPB include: Ammonia Recovery, Liquid Waste Treatment, and Waste Solidification. The location of Bldg. 530 is shown in Chapter 10, Figure10.1.

15.15.1 Safety Considerations

The document, *Integrated Safety Analysis Summary Blended Low Enriched Uranium Project Oxide Conversion and Effluent Processing Buildings*, contains discussions of the criticality safety, radiological safety, chemical safety, fire safety and environmental safety bases for the processes in the EPB. Therefore, the information provided in the section (Section 15.15) is limited to brief descriptions of each of the EPB processes.

15.15.2 Ammonia Recovery

Liquid waste from the LE uranyl nitrate conversion process is primarily a 10% ammonium nitrate solution. This liquid waste is pumped from the OCB into a receipt tank inside the EPB. This receipt tank also receives liquid discharges from the ammonia recovery fume scrubber and an in-line sodium analyzer. The ammonia stripping column bottoms stream and the stripping column distillate stream can also be sent to the receipt tank.

Liquid waste in the receipt tank is periodically pumped to a feed tank for the stripping column. A sodium hydroxide solution is added to the liquid waste while it is in the feed tank. The sodium hydroxide reacts with the ammonium nitrate to form ammonium hydroxide and sodium nitrate, which will allow the ammonia to readily separate from the liquid waste stream while in the stripping column. The sodium hydroxide feed rate is controlled by monitoring the pH of the liquid waste. The solution is then pumped to the stripping column through a heat exchanger that is heated using the stripping column bottoms solution.

The ammonia stripping column uses steam to separate out reusable ammonia. The ammonia vapor distillate leaving the column is routed through a water-cooled condenser. The resulting liquid stream (ammonium hydroxide solution) is collected in a distillate tank. Deionized water can be added to the vapor stream in the distillate tank to obtain the desired ammonia concentration in the ammonium hydroxide solution. The solution is then pumped to the OCB's ammonium hydroxide tank for reuse. A sodium analyzer checks the distillate to detect any carryover of sodium from the stripping column. The bottoms stream from the stripping column is recycled back to the receipt tank or sent to the feed tank for Liquid Waste Treatment.

15.15.3 Liquid Waste Treatment

The stripping column bottoms stream, primarily a sodium nitrate solution, is collected in a feed tank. This stream contains the radionuclides that did not precipitate out with the ADU plus uranium at about 1 ppm. This tank serves as lag storage between the ammonia stripping column and an evaporator.

The sodium nitrate solution is pumped to a steam-heated evaporator where water is boiled off thereby concentrating the sodium nitrate solution. The evaporator overhead stream (water vapor) is routed through a condenser and then to one of two overheads tanks. The water in the overheads tanks is sampled, analyzed, verified to meet the limits in the sewer discharge permit, and then discharged to the sanitary sewer. The evaporator bottoms are routed through a cooler to a bottoms tank.

15.15.4 Waste Solidification

The pH of the evaporator bottoms is adjusted with nitric acid while the solution is in the bottoms tank. The evaporator bottoms are then pumped to a mixer and combined with clay and cement. The mixture is discharged into bulk bags to cure and then be shipped to a licensed disposal facility.