EXHIBIT 1

Environmental Assessment for Proposed License Amendments to Special Nuclear Material License No. SNM–124 Regarding Downblending and Oxide Conversion of Surplus High-Enriched Uranium

Nuclear Fuel Services, Inc.
Erwin, Tennessee Plant

Docket 70-143

U.S. Nuclear Regulatory Commission
Division of Fuel Cycle Safety and Safeguards, NMSS

Prepared by **Center for Nuclear Waste Regulatory Analyses**
San Antonio, Texas

June 2002

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ABBREVIATIONS AND ACRONYMS

ADU	ammonium diuranate
ALARA	as low as is reasonably achievable
BLEU	Blended Low Enriched Uranium
BPF	BLEU Preparation Facility
CSX	CSX Corporation
DOE	U.S. Department of Energy
EA	environmental assessment
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EPB	Effluent Processing Building
ER	environmental report
FEIS	Final Environmental Impact Statement
HDPE	high density polyethylene
HEPA	high efficiency particulate air
HEU	high enriched uranium
LEU	Low Enriched Uranium
LLRW	low-level radioactive waste
NEPA	National Environmental Policy Act
NFS	Nuclear Fuel Services, Inc.
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
OCB	Oxide Conversion Building
PSD	Prevention of Significant Deterioration
RAI	request for additional information
ROD	Record of Decision
ROI	region of interest
SNM	Special Nuclear Material
SRS	Savannah River Site
TBD	to be determined
TDEC	Tennessee Department of Environment and Conservation
TVA	Tennessee Valley Authority
UN	uranyl nitrate
UNB	Uranyl Nitrate Building
WWTF	Waste Water Treatment Facility

1. PURPOSE AND NEED FOR ACTION

1.1 Introduction

On March 4, 2002, the U.S. Nuclear Regulatory Commission (NRC) issued a notice of intent to prepare an environmental assessment (EA) for amendment of Special Nuclear Material (SNM) License No. SNM–124 for Nuclear Fuel Services, Inc., Erwin, Tennessee (Ref. 1) The license amendments are necessary to obtain NRC authorization for NFS to construct and operate additional processing facilities as part of the Blended Low Enriched Uranium (BLEU) Project.

To avoid segmentation of the environmental review, NFS has submitted environmental documentation for three proposed license amendments; 1) to construct and operate a Uranyl Storage Building (UNB), 2) to construct and operate an Oxide Conversion Building (OCB) and an Effluent Processing Building (EPB), and 3) to relocate the downblending operations onsite. This documentation is found in a supplemental Environmental Report (ER) (Ref. 2) and additional information letters dated January 15, 2002 (Ref. 3), March 15, 2002 (Ref. 4), and April 12, 2002 (Ref. 5). The NFS environmental documentation was used by NRC staff to prepare this EA pursuant to the Council on Environmental Quality regulations [40 CFR Parts 1500–1508 (Ref. 6)] and the NRC Regulations [10 CFR Part 51 (Ref. 7)], which implement the requirements of the National Environmental Policy Act (NEPA) of 1969 (Ref. 8).

The purpose of this document is to assess the environmental impacts of the proposed license amendments for the NFS portion of the BLEU Project. Because the proposed BLEU Project is a limited addition to existing plant operations, this EA also is limited to the proposed BLEU Project activities at the Erwin Plant and any cumulative impacts on existing plant operations. The existing conditions and operations, for the entire Erwin facility, were evaluated by NRC for environmental impacts in a 1999 EA related to the renewal of the NFS license (Ref. 9).

This EA does not serve as approval for the three proposed activities, rather it assesses the environmental impacts of the actions. As each amendment application is submitted, the NRC staff will do a safety evaluation, which will be the basis for the approval or denial of the requests. As part of the safety evaluation, the NRC will perform an environmental review. If the review indicates that this EA effectively assesses the environmental effects of the proposed action, then no further assessment will be performed. However, if the environmental review indicates that this EA does not fully evaluate the environmental effects, another EA [or environmental impact statement (EIS)] will be prepared in accordance with NEPA.

1.2 Site History

NFS has operated nuclear fuel fabrication and uranium recovery facilities on its Unicoi County property in the town of Erwin, Tennessee, since 1959. The facility produces nuclear fuel for the [redacted] Principal operations include the processing of high enriched uranium (HEU) into a classified fuel product, and processing scrap materials containing HEU, to recover uranium.

The long site history has resulted in some areas of the site (including groundwater) becoming contaminated with radiological and chemical constituents (Ref. 9). The NFS Erwin Plant has been engaged in various decommissioning activities that are expected to continue over the duration of the current license. These ongoing efforts in contaminant source reduction are expected to reduce the potential for migration of additional contaminants from impacted site areas. As a result, environmental concentrations of a number of contaminants, from past operations, are expected to decrease with time. Continued monitoring of plant effluents and site contamination to demonstrate compliance with existing State and Federal regulations provides confidence that continued operations at the facility can be conducted while public health and safety and protection of the environment are being maintained.

1.3 Description of the Proposed Action

The proposed action currently before the NRC is to allow NFS to construct and operate a Uranyl Nitrate Storage Building (UNB) outside the NFS protected area. The other activities which were considered to contribute to the environmental impacts for this project are to increase the ^{235}U possession limit, to construct and operate an Oxide Conversion Building, to construct and operate a new Effluent Processing Building, and to relocate HEU to LEU downblending operations within the NFS protected area. HEU is defined by the U.S. [redacted] as uranium enriched in the isotope ^{235}U to 20 percent or greater, at which point it becomes suitable for use in nuclear weapons (Ref. 10). [redacted] LEU as uranium with a content of isotope ^{235}U greater than 0.7 percent and less than 20 percent and is not suitable for use in nuclear weapons (Ref. 10). The duration of the project is five years from the time that material is delivered to the site. A total of 461,000 kg of uranium (as LEU) will be processed in the BLEU complex with an approximate annual throughput of [redacted] of uranium (as LEU) per year.

The DOE has prepared an EIS which evaluated several options for the disposition of surplus HEU. The option chosen in that EIS was to downblend a portion of the surplus HEU as commercial fuel at the NFS site, and to downblend the rest of it to waste at the Savannah River Site. The environmental impacts of this option are discussed at length in the DOE EIS (Ref. 10). This EA serves to evaluate the site-specific impacts, which were not evaluated at length in the DOE EIS. The DOE EIS was used to prepare this document, and is referenced when the analyses were appropriate. Where it is not referenced, the NRC performed an independent analysis.

The first of the three license amendment applications was submitted to the NRC in a letter dated February 28, 2002. The application contains a request to authorize the licensee to store LEU-bearing material at the Uranyl Nitrate Building. Low enriched uranyl nitrate solutions, prepared by the Westinghouse Savannah River Company at the DOE's Savannah River Site near Aiken, South Carolina, will be shipped to the UNB beginning in early 2003. These uranyl nitrate solutions will be limited to a weight percent enrichment of ≤5 percent of ^{235}U and transported from Savannah River Site (SRS) to NFS in Type B packages. Low enriched uranyl nitrate solutions will also be produced in the downblending facility onsite and stored in the USB. The UNB will contain approximately 24 LE uranyl nitrate tanks, each having a capacity of [redacted]

The second of the three license amendment applications is expected to be submitted to the NRC by the end of July 2002. This application will contain information regarding specific license changes necessary to downblend HE UAl_x alloy and HEU metal to LE uranyl nitrate solutions within the NFS protected area.

The third of the three license amendment applictions is expected to be submitted to the NRC by January 2003. This appliction will request authorization to operate the LEU conversion process and effluent processing facilities. Once operational, uranyl nitrate solutions stored at USB will be *converted to UO_2 powder through the ammonium diuranate (ADU) process.*

The final approval or denial of the proposed activity will be documented in a safety evaluation report prepared by the NRC. This EA serves to evaluate the environmental effects of the proposed actions, but it does not constitute an amendment to the license.

1.4 Need for Proposed Action

Framatome ANP Inc. has contracted with NFS to downblend surplus HEU material to an LEU dioxide. The NFS LEU dioxide product is expected to be converted to commercial reactor fuel to be used by a Tennessee Valley Authority (TVA) nuclear power reactor; however, the NFS proposed action is limited to the production of LEU dioxide. The BLEU Project is part of a DOE program to reduce stockpiles of surplus HEU through re-use or disposal as radioactive waste. Re-use as LEU is considered the favorable option by the DOE because (1) weapons grade material is converted to a form unsuitable for nuclear weapons (addressing a proliferation concern), (2) the product can be used for peaceful purposes, and (3) the commercial value of the surplus material can be recovered (Ref. 10). An additional benefit of re-use is to avoid unnecessary use of limited radioactive waste disposal space.

1.5 References for Section 1

1. NRC, "Notice of Intent to Prepare an Environmental Asessment for Amendment of SpecialNuclear material License SNM-124 for Nuclear Fuel Services, Inc., Erwin, Tennessee." *Federal Register.* Vol. 67. pp. 9791-9792. March 4, 2002.

2. B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "Supplemental Environmental Report for Licensing Actions to Support the BLEU Project," November 9, 2001.

3. B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "Additional Information to Support an Environmental Review for BLEU Project," January 15, 2002.

4. B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "NFS Responses to NRC's Request for Additional Information to Support an Environmental Review for the BLEU Project," March 15, 2002.

5. B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "Clarification of NFS Responses to the RAI Supporting NRC's Environmental Review for the BLEU Project," April 12, 2002.

6. U.S. Code of Federal Regulations, "Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act," Parts 1500–1508, Chapter 5, Title 40, *Protection of the Environment.*

7. U.S. Code of Federal Regulations, "Environmental Protection Regulations for Domestic Licensing and Regulatory Functions," Part 51, Chapter 1, Title 10, *Energy.*

8. National Environmental Policy Act, as amended, 42 U.S.C. § 4321, *et seq.*, 1970.

9. T. Cox, U.S. Nuclear Regulatory Commission, Letter to T.S. Baer, Nuclear Fuel Services, Inc., "Finding of No Significant Impact and Environmental Assessment (TAC NO. L30873)," January 29, 1999.

10. U.S. Department of Energy, "Disposition of Surplus High Enriched Uranium Final Environmental Impact Statement," Volume 1, June 1996 (DOE/EIS–0240).

2. THE PROPOSED ACTION AND ALTERNATIVES

Alternatives considered for the NFS Erwin Plant include: (1) the proposed action (amending the NFS license to authorize construction and operation of the UNB; and (2) the no action alternative (not amending the license). Other alternatives to the proposed action were included in the DOE EIS and were not re-analyzed in this EA.

2.1 The Proposed Action: License Amendment for Actions Related to the BLEU Project

The processing operations for the proposed action are discussed in Section 2.1.1; the utilities or support operations are discussed in Section 2.1.2; effluents to air, water, and generation of solid waste are discussed in Section 2.1.3; and Section 3.1.3 discusses the radiation protection program. Facilities described in the following sections can be located in Figures 2.1 and 2.2.

2.1.1 Description of the Proposed Processing Operations

2.1.1.1 The BLEU Project

Downblending operations will be carried out at the BLEU Preparation Facility (BPF) to be located in Building [redacted] within the NFS Protected Area. Some existing equipment will be relocated from the NFS [redacted] Complex for use in this process. The downblending process will produce low enriched uranyl nitrate (UN) solution (Ref. 1).

The UN solution will be stored and processed into uranium dioxide (UO_2) powder at the BLEU Complex, a new facility to be built outside the protected area. The UO_2 powder will be shipped offsite for the manufacture of nuclear fuel assemblies for TVA reactors (Ref. 1). Three new buildings will be constructed on the site referred to as the BLEU Complex; uranyl nitrate building, oxide conversion building, and effluent processing building. The approximate sizes of each building are [redacted] and [redacted] respectively.

2.1.1.2. Operations at the BPF

Process equipment previously used in the NFS [redacted] Complex will be relocated to an existing but inactive production area in Building 333, to be designated as the BPF. Approximately [redacted] of HEU aluminum alloy and [redacted] of HEU metal (buttons) will be used to produce high-enriched UN. This will be downblended with UN produced from [redacted] of natural uranium oxide to give the required low-enriched UN solution in [redacted] batches (Ref. 1).

A multi-stage process will be used to convert the HEU aluminum alloy to UN solution. The aluminum will be first stripped from the HEU aluminum alloy ingots in a dissolver with geometry favorable to nuclear safety. Sodium hydroxide (30 percent solution), sodium nitrate (45 percent solution), and barium hydroxide will be trickled over the ingots, dissolving the aluminum and leaving behind a sodium diuranate ($Na_2U_2O_7$) precipitate containing the uranium. Sodium nitrate suppresses the formation of hydrogen during the dissolution reaction forming ammonia instead. The small amount of hydrogen that is produced will be diluted with air to a safe concentration (Ref. 2). The sodium diuranate solid will be separated from the solution and dissolved in nitric acid (70 percent solution) to produce UN [$UO_2(NO_3)_2$] solution. The UN solution will then be purified using a previously licensed liquid-liquid extraction process (NRC

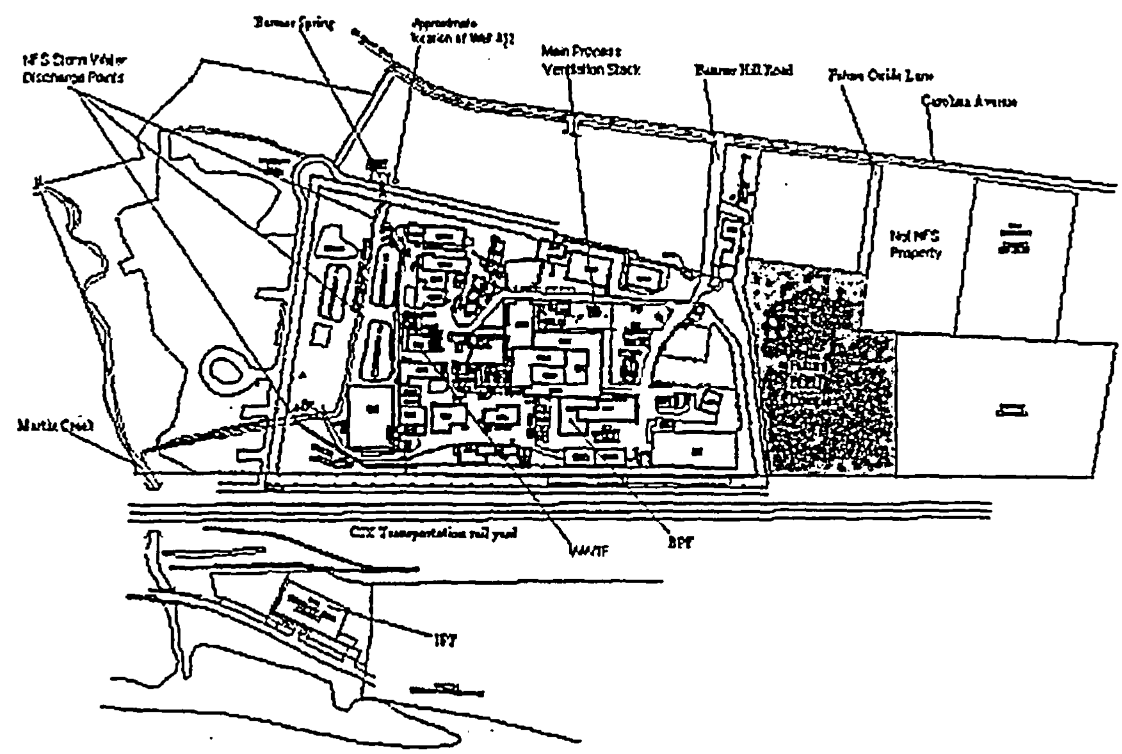

Figure 2.1 The NFS Site (Ref. 1)

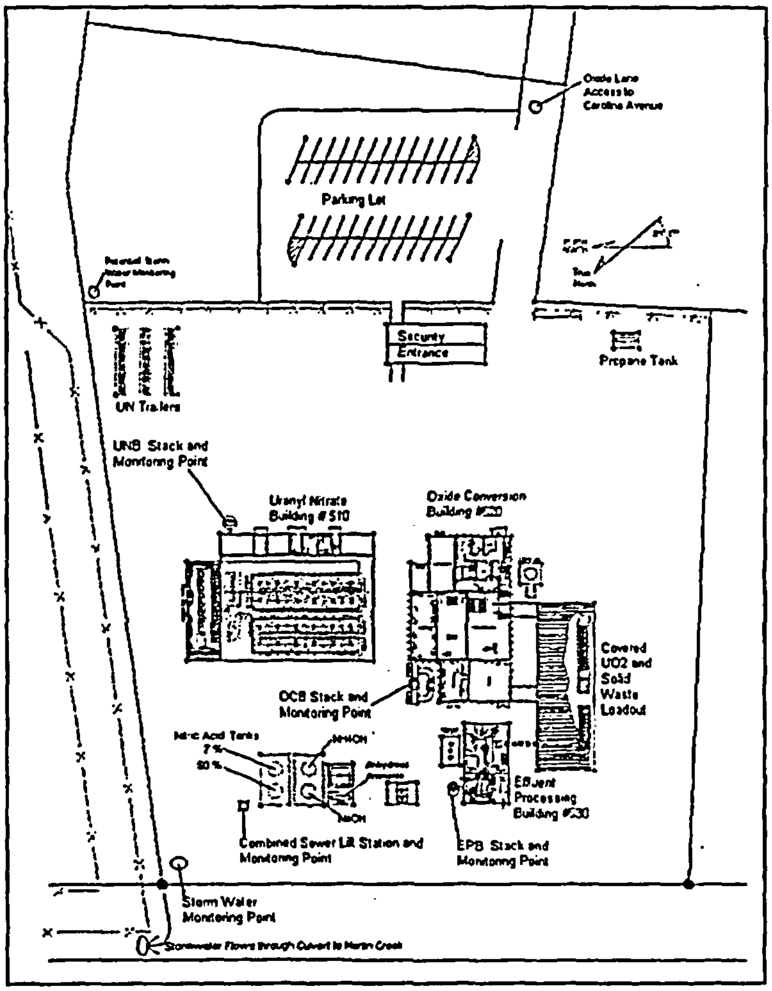

Figure 2.2 BLEU Complex layout (Ref. 1)

License SNM–124). This system, however, will be designed so that a wet-pipe sprinkler system will not be required for fire suppression (Ref. 2).

A new system will be used to convert the HEU metal (buttons) into UN solution. The HEU metal will be first converted to oxide by heating it in a furnace with favorable nuclear geometry in the presence of air. The oxide will then be transferred to a dissolver with geometry favorable to nuclear safety and reacted with nitric acid (70 percent solution) and hydrogen peroxide (30 percent solution) to produce UN solution (Ref. 2).

The natural uranium oxide will be likewise dissolved in nitric acid to produce natural UN solution blendstock for diluting the high-enriched UN in the downblending process.

The high-enriched UN will be downblended to low-enriched UN, using a previously licensed batch process (NRC License SNM–124). This system, however, will employ larger capacity tanks. The blendstock dissolver tank will hold [redacted] and the enrichment blend tank will hold [redacted] The limits on ^{235}U concentration will remain the same (Ref. 2).

Basic and acidic waste solutions will be collected separately in two bermed [redacted] tanks located adjacent to the BPF and pumped to the Waste Water Treatment Facility (WWTF) for treatment (Ref 2).

2.1.1.3 <u>Operations at the UN Building</u>

The Uranyl Nitrate Building (UNB) is located in the proposed BLEU Complex. This new facility will store up to [redacted] of low-enriched UN solution received from the BPF. The UN solution will be stored in 24 high density polyethylene (HDPE) tanks arranged in 4 rows of 6. Each tank will have a capacity of [redacted]. The UNB will also house a [redacted] tank for storing natural UN blend stock produced from uranium trioxide (UO_3) in the Oxide Conversion Building (OCB). This product will be shipped to the SRS in [redacted] batches using tank trailers. A central control and instrumentation system will be used to monitor and control the UNB operations. The UNB will have a berm of [redacted] capacity for spill containment (Ref. 2).

2.1.1.4 <u>Operations at the OCB</u>

Low-enriched UN solution will be converted to UO_2 powder in the proposed OCB, using the Framatome ANP, Inc. process. This process has been used for over 20 years at the Framatome ANP, Inc., Richland Plant, under NRC License SNM–1227. The liquid waste processing system to be used at the OCB for concentration of dilute sodium nitrate waste stream, however, is not used at Richland. An overview of the processes occurring at the proposed BLEU Conversion Complex is shown in Figure 2.3. The areas that do not have a parallel in Richland are the UNB and the Liquid Waste Processing System. These are shown within dashed borders in the diagrams.

In the oxide conversion process, the UN solution is first mixed with ammonium hydroxide and water to produce ADU solids. The ADU [$(NH_4)_2U_2O_7$] solids are then separated using a continuous centrifuge and cross filter. The solids are next dried in a screw dryer and then

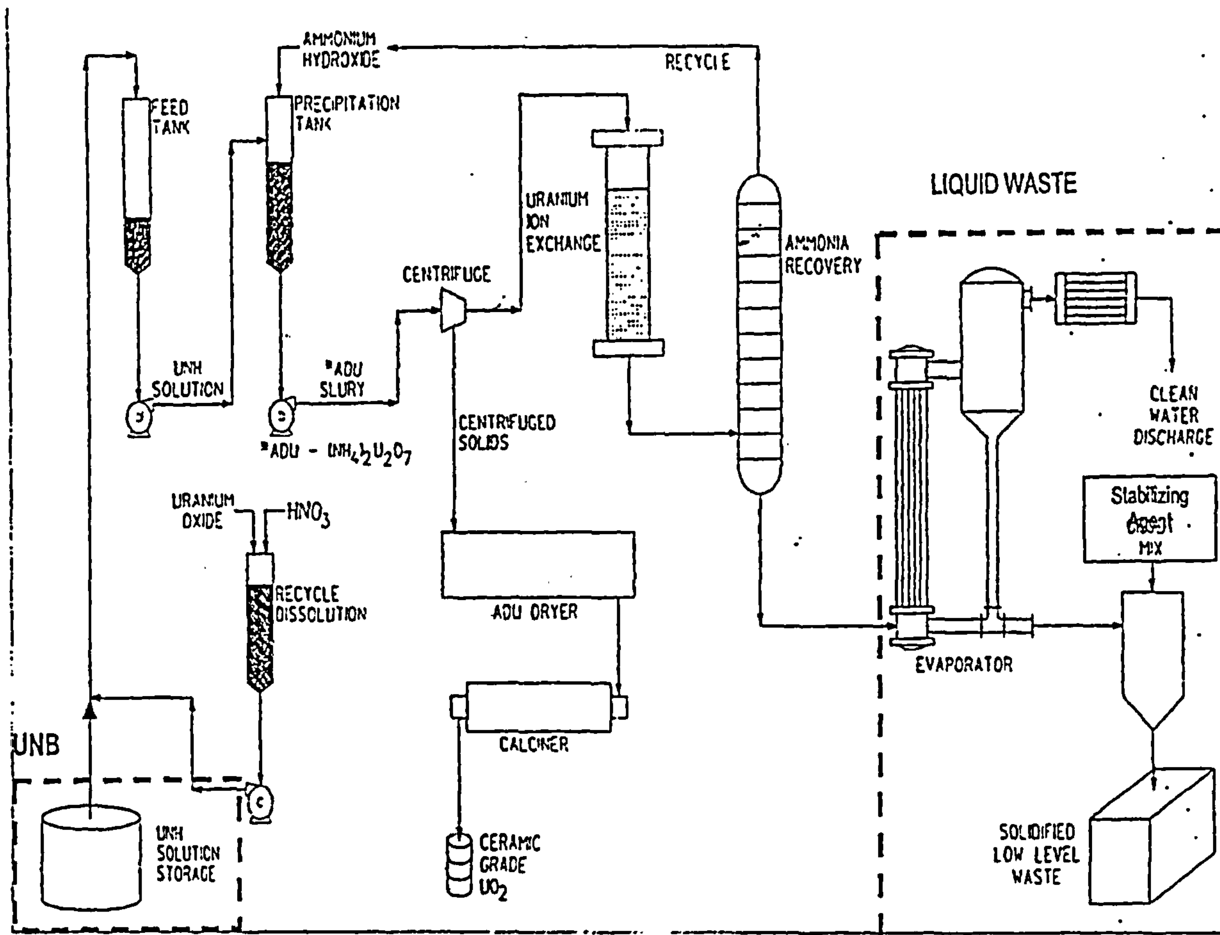

Figure 2.3 ADU conversion process (Ref. 2)

calcined in an electrically heated rotary kiln under a counter current flow of steam and hydrogen (from cracked ammonia) to reduce the ADU to UO_2 powder.

The UO_2 powder is packaged in containers, over packed, and shipped to the Framatome ANP, Inc. facility in Richland, Washington (Ref. 1).

The dilute stream from the ADU centrifuge is passed through ion exchange columns for extraction of uranium. The extracted uranium is recycled to the oxide conversion process after being eluted from the loaded ion exchange resin. The stream is then sent to the Effluent Processing Building (EPB) for further treatment.

Dissolution of natural uranium trioxide (UO_3) in nitric acid to UN solution will also be conducted in the OCB. The natural UN solution will be stored in the UNB for shipment to SRS for use in downblending operations at that location.

2.1.1.5 Operations at the EPB

The liquid effluent stream from the OCB will be further treated in the EPB in a two-step process. Sodium hydroxide will be added to the OCB effluent stream, and ammonia will be recovered by steam stripping in multi-stage contactor columns. The recovered ammonia will be returned to the oxide conversion process. The bottoms stream will be further treated in the new liquid waste processing system mentioned above. This stream, which consists primarily of dilute sodium nitrate in water, will be fed to an evaporator, resulting in a concentrated [redacted] sodium nitrate solution, which will be further processed into a solid waste for disposal (Ref. 2). The overheads stream from the evaporator will be held in one of two [redacted] carbon steel tanks, sampled for verification of compliance with the pretreatment permit, and discharged to the sanitary sewer (Ref. 1). Hazards associated with this new process include carryover ammonia present in the feed stream from the ADU centrifuge, and potential operator exposure to dust from the solidifying agent.

2.1.2 Utilities or Support Operations

Utilities and support facilities will be required to perform process operations in the proposed BLEU Project facilities. The utilities needed for the BLEU Project are water, electricity, diesel oil, and natural gas. Table 2-1 summarizes the estimated usage of utilities for the BLEU Project facilities, and compares the usage with existing usage for NFS operations. The information has been extracted from Attachment 1 of the NFS additional information letter (Ref. 3).

Table 2-1 shows that the usage of natural gas at the NFS Erwin site will be significantly increased if the BLEU Complex facilities come on-line, and generation of resultant waste could be significant. Utility requirements have been considered in the DOE Final Environmental Impact Statement (FEIS) (Ref. 4). The DOE FEIS notes that even though the generation of waste based on increased usage of utilities is significant, NFS has adequate capacity to accommodate the increase since it is not currently operating at full capacity (i.e., past utility use at NFS has exceeded estimates for the proposed action).

Other support facilities in the plant are described in the license renewal EA (Ref. 5). The process flow schematic showing water balance information for the Waste Water Treatment

Table 2.1 Comparison of current NFS utility usage with estimated usage for the proposed BLEU Project facilities

	NFS Current Operations	Downblending (BPF)	BLEU Complex
Water usage (m^3/yr)	59,000	<3,000	5,700
Electrical Usage (MWh/yr)	18,260[a]	3,000	3,800
Diesel Oil (m^3/yr)	21.505[a]	0	1.893[b]
Natural Gas (m^3/yr)	7,813[a]	0	266,208
Coal (kg/yr)	0	0	0
Steam (kg/hr)	6,260	0[c]	0[d]

[a] The value from actual NFS billing data for 2000.
[b] *The quantity of diesel fuel is a stored volume for emergency power generation.*
[c] The electrically heated steam boiler used in the BPF facility will be a closed-loop system with no liquid discharge.
[d] The gas-fired steam boiler used at the BLEU Complex will be a closed-loop system with no liquid discharge.

Source: B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "Additional Information to Support an Environmental Review for BLEU Project," January 15, 2002.

Note:
BPF = BLEU Preparation Facility
BLEU = Blended Low-Enriched Uranium

Facility (WWTF) and the Ground Water Treatment Facility is shown in Figure 2.2 of the license renewal EA (Ref. 5). The water balance for the BLEU Complex is provided in Figure 1 of Attachment 2 of the NFS additional information letter (Ref. 3). This diagram indicates that the BLEU Complex is expected to use 45 m^3 (11,900 gal) per day of water and discharge [redacted] (4,510 gal) per day to the atmosphere, [redacted] per day to the sewer, and [redacted] (590 gal) per day to the disposal facility. Finally, the water balance diagram for the BPF is given in Figure 2 of the license renewal EA (Ref. 3). The BPF draws less than 7.08 m^3 (1,870 gal) per day from city water, uses 1.2 m^3 (320 gal) per day in the low-enriched UN solution, and discharges less than 5.87 m^3 (1,550 gal) per day to the WWTF.

Approximately 20 major process chemicals and mixes are used in the BLEU Project. The chemicals used, amounts stored, storage locations, and controls used to ensure accident-free operation are listed in Attachments II and III of the NFS request for additional information (RAI) response (Ref. 2).

2.1.3 Effluents to Air and Water and Generation of Solid Waste

The proposed BLEU Project will generate gaseous, liquid, and solid wastes. This section describes the nature of these streams and waste management practices.

2.1.3.1 Effluents to Air

BLEU Project activities are expected to generate airborne emissions from process stacks and fugitive dust from construction of the BLEU Complex. The total estimated volume of soil to be disturbed during construction of the BLEU Complex is 150 m^3 (5400 ft^3). Fugitive dust from construction will have a negligible impact on radiological dose (0.0112 mrem). NFS will employ wet suppression or equivalent methods to control fugitive dust. Area and personnel monitoring will ensure that workers do not receive excess exposures.

Airborne effluents are discharged from process stacks in accordance with operating permits issued from the Tennessee Air Pollution Control Board and NRC regulations. For the BPF, the process ventilation system will collect the process off-gases from the individual process points throughout Building 333 (Ref. 1). The combined off-gases will be treated by an air pollution control system consisting of wet scrubbing and high-efficiency particulate air (HEPA) filtration. The wet scrubber will remove chemical compounds and the HEPA filters will remove particulates from the off-gas effluent before release through the NFS main stack (Stack No. 416). Location and physical characteristics of the NFS main stack are provided in the license renewal ER (Ref. 5).

Exhaust stacks at the proposed BLEU Complex are planned for the OCB, UNB, and EPB. Table 2.2 presents the diameter, height, velocity, constituents released, and pollution control device for each of these process stacks (Ref. 3). The OCB stack will discharge emissions from two processes: oxide conversion and uranium dissolution. Each process emission will be treated with a packed bed scrubber before building HEPA filtration. The building exhaust for the UNB will be HEPA filtered prior to release through the stack. The building exhaust for the EPB will be treated with a packed bed scrubber before release through the stack.

Table 2.2 Physical characteristics of exhaust stacks at the BLEU Complex

Building	Stack Number	Effective Diameter (m)	Stack Height	Gas Exit Velocity (m/s)	Expected Effluents	Pollution Control Devices
Uranyl Nitrate Building	501	0.35	15.2	9.6	U	HEPA Filtration
Oxide Conversion Building	502	0.66	16	9.4	U, NO_x, NH_3	HEPA Filtration, Packed Bed Scrubber
Effluent Processing Building	503	0.37	13.7	9.5	NH_3	Packed Bed Scrubber

Source: Nuclear Fuel Services, Inc., "Additional Information to Support an Environmental Review for BLEU Project," Docket No. 70-143, January 15, 2002.

Table 2.3 provides a comparison of historical radiological emissions to expected BLEU Project radiological emissions. The estimates for the WWTF represent fugitive emissions (Ref. 2). Under the proposed action, both uranium and thorium air emissions are expected to increase by a factor of about 4 to 5 times current levels. Dose impacts from these increased releases are shown to be small (Section 5, Table 5.2) in relation to 10 CFR Part 20 (Ref. 6) limits.

Nonradiological air emissions are summarized in Table 2.4. Effluent air emissions from the BPF will be discharged through the existing main NFS stack. The current emissions estimates (Table 2.4) include 200 Complex releases (now discontinued) that are expected to bound the BPF air quality impacts (Ref. 1). As a result, a separate column for BPF effluent estimates is not included in Table 2.4. Almost a doubling of current NFS plant hydrogen and nitrogen oxide emissions is expected if the proposed BLEU Complex emissions are added to existing releases. For nitrogen oxides, Table 2.4 indicates NFS will exceed the current allowable limit; however, NFS is requesting modification to the existing air pollution control permit for the main stack. Modification of the permit is required because of changes in material input from the BPF and

Table 2.3 Comparison of NFS Erwin Plant historical radiological air emissions to estimated BLEU Project air emissions (Ci/yr)[a]

	Current Averages[b]		Estimated BLEU Project Effluents			Effluent Totals	
Effluent	Main Stack	All Other Stacks	BPF[c]	BLEU Complex	NFS WWTF	Current	BLEU Project
Uranium	2.8E-04	3.1E-05	1.1E-03	2.3E-05	4.7E-05	3.1E-04	1.2E-03
Thorium	5.7E-07	7.2E-06	1.7E-05	3.4E-07	2.0E-05	7.8E-06	3.7E-05
Plutonium	0.0E+ 00	4.7E-05	1.4E-07	2.8E-09	1.6E-07	4.7E-05	3.0E-07
Americium	0.0E+ 00	9.4E-07	2.5E-09	5.0E-11	2.9E-09	9.4E-07	5.4E-09

[a] To convert curies to becquerels, multiply by 3.7E+10.
[b] Current averages are based on release data from 1996 through 2000, which were obtained from the NFS *Safety Department Semiannual Reports.*
[c] The BPF gaseous effluents will be released through the Main Stack.

Source: Nuclear Fuel Services, Inc., "Additional Information to Support an Environmental Review for BLEU Project," Docket No. 70-143, January 15, 2002.

Table 2.4 Comparison of estimated nonradiological air emissions from the BLEU Complex with current facility estimates (tons/yr)[a]

Effluent	Current Emissions	BLEU Complex	Currently Allowable
Hydrogen	3.4	2.3	6.5
Nitrogen Oxides	20.6	19.6	36.4
Ammonia	20.9	0.8	74.8

[a] Tons in English (short ton) units; to convert to kilograms, multiply by 908.

Source: Nuclear Fuel Services Inc., "Supplemental Environmental Report for Licensing Actions to Support the BLEU Project," Docket No. 70-143, November 9, 2001.

installation of additional process and ventilation equipment. This modified permit for the main stack has not been issued as of this EA; however, NRC expects the State, under its authority to regulate air quality, will continue to set permit levels to limit environmental impacts from NFS effluents.

A fraction (about 6 percent) of the proposed 0.018-km^2 (4.5-acre) BLEU Complex construction site contains soil with measured radionuclide concentrations above naturally occurring soil concentrations (Ref. 3). Construction of the BLEU Complex will involve excavating and moving this contaminated soil which would generate fugitive dust containing radionuclides. During construction, wet suppression or equivalent methods will be used to control fugitive dust emissions. Section 3.9.1 contains additional details including a conservative dose estimate for proposed construction activities at this location.

2.1.3.2 Effluents to Water

The proposed BPF and BLEU Complex are expected to produce liquid effluents. BPF waste streams will be sent to the NFS WWTF and discharged into the Nolichucky River in accordance with the National Pollutant Discharge Elimination System (NPDES) permit and NRC radiological effluent limits in 10 CFR Part 20 (Ref. 6). This liquid effluent will consist of raffinate, condensate, scrubber waste solution, and sodium hydroxide. The basic and acidic waste streams will be treated using precipitation and ion exchange processes. Treatment of BPF process wastewater will not require modification to the existing NPDES permit because no new processing chemicals will be used nor will the additional throughput exceed permitted discharage limits (Ref. 2). Operation of the BPF will require the addition of five new waste storage tanks: two 7.570-m^3 (2,000-gal) tanks for acidic waste streams, two 7.570-m^3 (2,000-gal) tanks for basic waste streams, and a 3.785-m^3 (1,000-gal) tank that will be used for wet scrubber waste solutions. One 56.775-m^3 (15,000-gal) storage tank will also be added to the WWTF as part of the proposed action. Estimated radiological effluents from the WWTF attributable to the BPF are identified in Table 5.1. Although substantial increases are shown for uranium, thorium, and plutonium, effluents from the proposed action in relation to current operations, the magnitude of the expected dose impact (shown in Section 5, Table 5.1) is not significant when compared to the 1 mSv/yr (100 mrem/yr) public dose limit and the 0.1 mSv/yr (10 mrem/yr) as low as is reasonably achievable (ALARA) constraint in 10 CFR Part 20.

Proposed BLEU Complex liquid effluents include storm water released to Martin Creek and sanitary sewage waste sent to the Erwin Publicly Owned Treatment Works (Ref. 1). Sanitary wastes consist of non-contact cooling water, treated process water, and domestic waste. All BLEU Complex scrubber waste solutions will be treated at the EPB. Scrubber wastes can contain amonium nitrate, dilute nitric acid, or dilute ammonium hydroxide (Ref. 1). In total, the BLEU Complex is estimated to discharge less than 38 m^3 (10,000 gal) of sanitary waste per day during conversion operations (Ref. 1). A separate Erwin Publicly Owned Treatment Works pretreatment permit will regulate this effluent. Tables 2.5 and 2.6 provide estimates of BLEU Complex radiological and nonradiological effluents that will be discharged into the sewer system.

Storm water run-off from the BLEU Complex will be independent of run-off from the NFS protected area and will be regulated under a separate NPDES storm water discharge permit (to be issued). The primary path for storm water run-off will be northwest across the BLEU

Complex and into culverts that empty into Martin Creek (Ref. 1).

Table 2.5 Estimated radiological constituents (Ci/yr) for the BLEU Complex sewer discharge

Constituent	Estimated Annual Release (Ci/yr)[a]
Uranium Isotopes	2.0E-04
Thorium Isotopes	1.3E-08
Plutonium Isotopes	4.3E-09
Technetium - 99	1.1E-03

[a] To convert curies to becquerels, multiply by 3.7E+10.

Note: The BLEU Preparation Facility will not discharge process material into the sanitary sewer.

Source: Nuclear Fuel Services, Inc., "Additional Information to Support an Environmental Review for BLEU Project," Docket No. 70-143, January 15, 2002.

Table 2.6. Estimated nonradiological constituents for the BLEU Complex sewer discharge

Constituent	*Estimated Value
Discharge Volume	6300 gpd
Ammonia (as Nitrogen)	<0.029 kg/day
Nitrate (as Nitrogen)	<0.28 kg/day
Fluoride	<0.0038 mg/l
Chloride	<0.0075 mg/l
Arsenic	<0.002 mg/l
Barium	<0.01 mg/l
Cadmium	<0.0001 mg/l
Chromium	<0.0006 mg/l
Lead	<0.0004 mg/l
Mercury	<0.0001 mg/l
Selenium	<0.0004 mg/l
Silver	<0.001 mg/l
pH	<9

* Estimates do not include domestic wastewater volume, which is estimated to be a combined total of <10,000 gallons per day. To convert gallons to cubic meters, multiply by 0.00378; and, to convert liters to cubic meters, multiply by 0.001.

Note: The BPF will not discharge process material into the sanitary sewer.

Source: Nuclear Fuel Services, Inc., "Additional Information to Support an Environmental Review for BLEU Project," Docket No. 70-143, January 15, 2002.

2.1.3.3 Solid Waste Management

Proposed BLEU Project operations are expected to produce several types of solid wastes: *radioactive, mixed, nonradioactive hazardous, and nonradioactive nonhazardous.*

Treatment of the proposed BPF liquid effluent by the WWTF will generate solid effluent classified as low-level radioactive waste (LLRW). An estimated 92.0 m^3 (3,250 ft^3) of LLRW press cake and 105 m^3 (3,700 ft^3) of other LLRW solids (cheesecloth, gloves, etc.) are estimated to be generated annually (Ref. 1). Uranium will be the primary constituent of this LLRW. The BLEU Complex will also produce LLRW. Proposed EPB operations are estimated to produce approximately 708 m^3 (25,000 ft^3) of LLRW annually in the form of stabilized still bottoms (Ref 1). Proposed BLEU Complex operations are estimated to produce approximately 60 m^3 (2,120 ft^3) of other LLRW solids (cheesecloth, gloves, etc.) annually (Ref. 1). Uranium will be the primary constituent of this LLRW. Radioactive wastes will be compacted to the extent practical and disposed of offsite at licensed waste disposal facilities.

Mixed waste is not expected to be generated in the BPF. However, the BLEU Complex may generate an estimated .42 m^3 (15 ft^3) of mixed waste from solvent and industrial adhesive use during maintenance activities (Ref. 1). This mixed waste will be temporarily stored onsite in accordance with the NFS hazardous waste permit.

Nonradioactive hazardous waste is not expected to be generated from the BPF. However, the BLEU Complex may potentially generate a small quantity of this waste from solvent and industrial adhesive use during maintenance activities (Ref. 1). This nonradioactive hazardous waste will be temporarily stored onsite and then shipped to an authorized treatment, storage, or waste disposal facility.

BPF operations will not significantly increase amounts of non-radioactive, nonhazardous waste currently being generated at the NFS Erwin Plant (Ref. 1). The BLEU Complex will generate approximately 113 m^3 (4,000 ft^3) of nonradioactive, nonhazardous waste annually (Ref. 1). This waste will consist of items such as paper products and cafeteria waste. These wastes will be stored onsite before shipment for recycling and/or disposal at appropriate facilities.

2.1.4 Radiation Protection Program

Under the existing NRC license, NFS maintains an NRC-approved radiation protection program to address radiological health and safety in accordance with the regulations in 10 CFR Part 20 (Ref. 6). NFS has considerable experience in uranium processing, has processed HEU in past operations, and has also conducted downblending of HEU on the existing plant site (Ref. 1). NFS has not identified any unique radiological safety issues, associated with the proposed action, that would require significant changes to the existing radiological safety procedures (Ref. 2). Radiation dose estimates for the proposed action are presented in Section 5.

One change NFS noted (Ref. 2) is the status of the site with respect to U.S. Environmental Protection Agency (EPA) Fuel Cycle standards in 40 CFR Part 190. Because the BLEU Project supports the production of nuclear generated electric power for public use, NFS will have to comply with a more stringent public dose constraint of 0.25 mSv/yr (25 mrem/yr) (Ref. 2). To address this change, NFS has submitted revised dose assessment methods for NRC review in the first license amendment request for the BLEU Project (Ref. 7). NRC staff will evaluate the new methods as part of the upcoming review of the amendment request so it will not be considered further in this EA.

2.2 Alternative 1: No Action

Under this alternative to the proposed action, NFS would not be authorized to construct and operate a new LEU Conversion Complex outside the NFS protected area, or increase the ^{235}U possession limit and relocate HEU to LEU downblending operations within the NFS protected area. This alternative would limit NFS participation in the BLEU Project and cause the work to be conducted at other facilities in the United States. As a result, environmental impacts associated with the proposed action are expected to be moved to another location, resulting in no net environmental gain.

2.3 References for Section 2

1. B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "Supplemental Environmental Report for Licensing Actions to Support the BLEU Project," November 9, 2001.

2. B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "NFS Responses to NRC's Request for Additional Information to Support an Environmental Review for the BLEU Project," March 15, 2002.

3. B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "Additional Information to Support an Environmental Review for BLEU Project," January 15, 2002.

4. U.S. Department of Energy, "Disposition of Surplus High Enriched Uranium Final Environmental Impact Statement", DOE/EIS-0240, Volume 1, June 1996.

5. T. Cox, U.S. Nuclear Regulatory Commission, Letter to T.S. Baer, Nuclear Fuel Services, Inc., "Finding of No Significant Impact and Environmental Assessment (TAC NO. L30873)," January 29, 1999.

6. U.S. Code of Federal Regulations, "Standards for Protection Against Radiation," Part 20, Chapter 1, Title 10, *Energy.*

7. B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "License Amendment Request to Support the UNB at the BLEU Complex," February 28, 2002.

3. AFFECTED ENVIRONMENT

3.1 Site Description

The NFS Erwin Plant is located in Unicoi County, Tennessee, about 32 km (20 mi) southwest of Johnson City, Tennessee. Asheville, North Carolina, is located 80 km (50 mi) to the southwest (Figure 3.1). The plant is about 0.8 km (0.5 mi) southwest of the Erwin city limits and lies on the southeastern edge of the Nolichucky River. The developed portion of the site is about 0.3 km (0.2 mi) from the river. The plant elevation is about 9 m (30 ft) above the nearest point on the Nolichucky River. The site occupies about 28 hectares (70 acres) and is located in a southwest-to-northeast-oriented valley, bounded by the Appalachian Mountains. The mountains to the immediate north and south of the valley have a maximum elevation of 756 m (2,480 ft) above sea level. The site elevation is 511 m (1,675 ft) above sea level. The site is bounded to the northwest by the CSX Corporation (CSX) railroad property and the Nolichucky River, and by Martin Creek to the northeast.

Proposed and current actions at the site will utilize 66 percent of the total 28.4 hectares (70 acre) site for NRC-licensed activities. The remainder of the site includes woods, brushland, shrub swamp, and open fields. A breakdown of the land use is provided in Table 3.1. Figure 2.1 shows the location of the existing facilities (e.g., BLEU prep facility and WWTF) and proposed facilities associated with the BLEU Project (proposed BLEU Complex) in relation to the other site facilities. Construction of the BLEU Complex will be on 2.0 hectares (5 acres) of previously cleared NFS land at the southern portion of the NFS site, beyond the current security area, but within the boundary of the NFS property. The OCB will be approximately ? (ft^2) and the UNB will be approximately (ft^2). The buildings will be constructed in accordance with state and local building codes.

3.2 Climate and Meteorology

3.2.1 Climatology

Data previously summarized by the NRC (Ref. 1) from the Bristol, Johnson City, and Kingsport, Tennessee, tri-city area, about 32 km (20 mi) northeast of the NFS Erwin Plant, is considered representative of meteorological conditions at the NFS site, and the related conclusions by the

Table 3.1 Land use on the NFS site

Use	Acreage[a]	Percent of site
Buildings and grounds	34.7	49.6
Former waste ponds and radiological burial grounds	11.6	16.6
Parking lots	9.6	13.8
Open fields	3.5	5.0
Woods, brush, and wetlands	10.5	15.0
Total	69.9	100.0

Source: NFS Environmental Designer in November 9, 2001, Letter from B.M. Moore (NFS) to Director, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission.

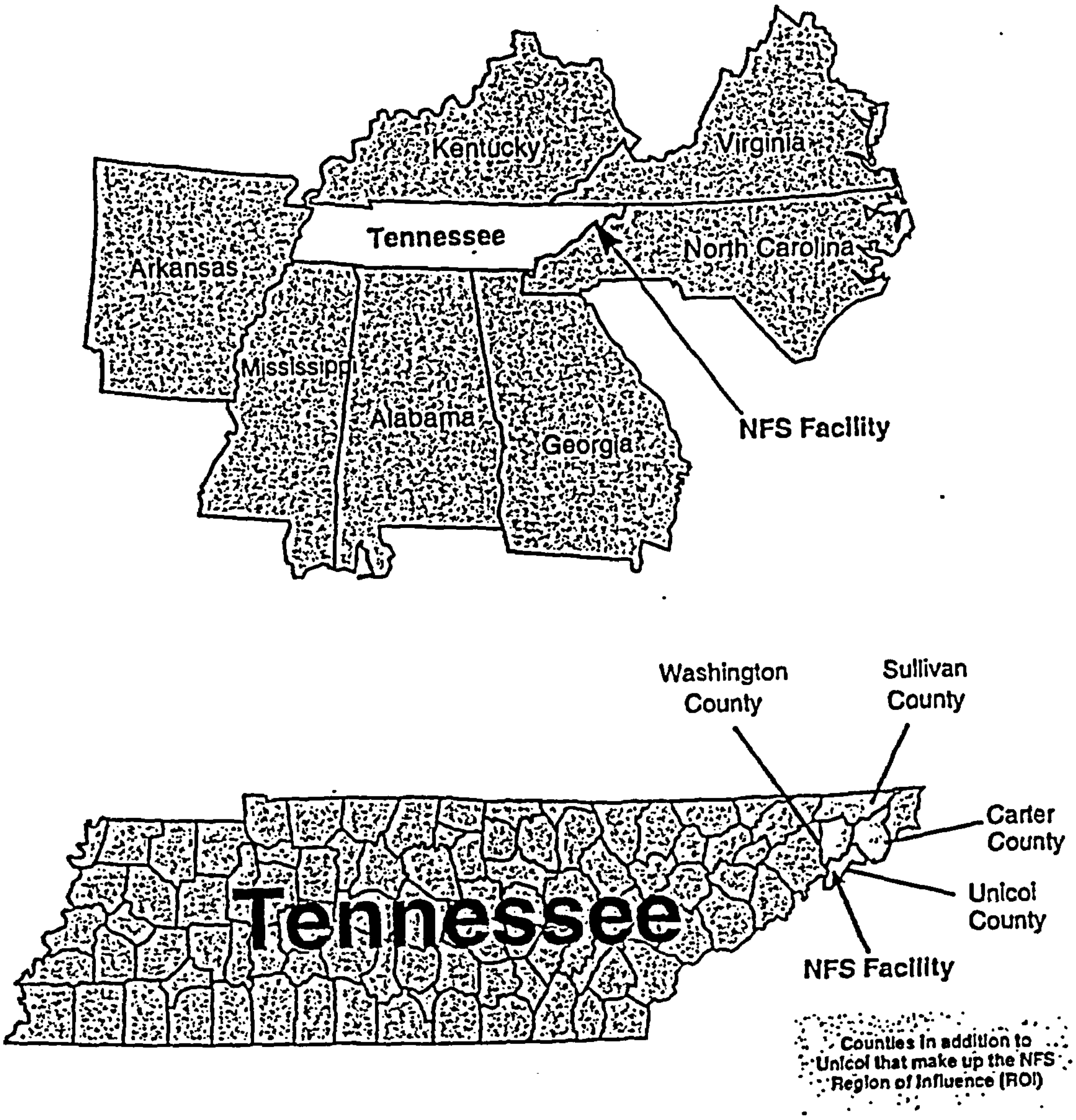

Figure 3.1 Location of the NFS Site (Ref. 3)

NRC (Ref. 1) remain applicable. The 30- to 60-year temperature and precipitation data collected through 1996 (Ref. 2) remain applicable in 2002. Recent temperature data (Ref. 3) show the average annual temperature in 2000 was 12.8 °C (55.1 °F), the average daily minimum temperature was -4.6 °C (23.8 °F) in January, and the average daily maximum temperature was 28.6 °C (83.4 °F) in July. Annual precipitation data (Ref. 3) for 1997–2000 ranged from about 94–130 cm (37–51 in). The recent temperature and precipitation data (Ref. 3) are similar to the historical values (Ref. 2).

3.2.2 Winds, Tornadoes, and Storms

Prevailing winds at the site tend to follow the orientation of the valley, southwest to northeast (Ref. 1). The 30-year average wind speed at the Kingsport, Tennessee airport was 3.1 m/s (6.9 mi/hr), prevailing from the southwest and northeast (Ref. 2). From 1991 to 1995 the winds at NFS were predominantly from the south, south-southwest, and southwest directions with an average annual speed of 3.4 m/s (7.6 mi/hr) (Ref. 1). The average number of thunderstorm days is 42.8, and only one tornado was recorded in Unicoi County between 1950 and 2000 (Ref. 4). The maximum sustained wind (2-minute duration) was 22.4 m/s (50 mi/hr) in 1951, and the peak gust wind (5-second duration) was 38.4 m/s (86 mi/hr) in 1995 (Ref. 2). The year 2000 showed a maximum sustained wind of 16.5 m/s (37 mi/hr) and a peak gust wind of 27.7 m/s (62 mi/hr) (Ref. 5).

3.2.3 Meteorology

Meteorological data summarized by NRC (Ref. 1) remains applicable in 2002. Wind speed and direction were summarized previously in Section 3.2.2. The area is characterized by a system of alternating and parallel ridges and valleys, which span in a southwest-to-northeast direction. Winds through the area are controlled by these ridge and valley systems, with winds generally moving northeasterly during the day and southwesterly during the night. Wind directions at NFS from 1991 to 1995 were reported to be from the south, south-southwest, and southwest 43 percent of the time, from the northwest and north-northwest about 17 percent of the time, and from the north, north-northeast, and northeast about 14 percent of the time (Ref. 1).

Measurements of stability class at NFS are limited and estimates are based on data collected in 1982 and 1983 (Ref. 1). Those data indicate stability classes occurred at the following frequencies: A (31 percent), B (24 percent), C (27 percent), D (20 percent), E (1 percent), and F (0 percent). As recommended previously by NRC (Ref. 1), limited data suggest it is appropriate that atmospheric modeling be based on Class A stability for elevated releases and Class F stability for ground-level releases, to give conservative estimates.

3.2.4 Air Quality

The NFS facility is located in the Eastern Tennessee-Southwestern Virginia Interstate Air Quality Control Region. The area can be classified as mostly low density rural residence with commercial and industrial activities (Section 3.3). All areas within this Air Quality Control Region are designated as in attainment with National Ambient Air Quality Standards as specified in 40 CFR Part 81.343 (Ref. 5). The Great Smokey Mountains National Park (in the vicinity of the Erwin Plant) is a Prevention of Significant Deterioration (PSD) Class 1 area.

Since the promulgation of the PSD regulations in 40 CFR 52.21 (Ref. 6) in 1977, no PSD permits have been required for any emission source at NFS (Ref. 4).

3.3 Demography, Socioeconomics, and Environmental Justice

The NFS Erwin Plant is located in Unicoi County, which had a population (Table 3.2) of 17,667 in 2000. The highest density of residential population is northeast in the city of Erwin, Tennessee. Other larger cities within an 80 km (50 mile) radius of the site include Asheville, North Carolina, about 80 km (50 mi) to the southwest, and Johnson City, Tennessee, about 32 km (20 mi) to the north.

The population change in Unicoi County from 1990 to 2000 was an increase of 6.8 percent, considerably less than the 16.7 percent change reported for Tennessee. The surrounding counties (Washington, Greene, Sullivan, and Carter) in Tennessee also grew at rates less than the statewide average. The nearest population center is the city of Erwin, Tennessee, with a population of 5,610 in 2000, an increase of about 11.8 percent over the 1990 population (Table 3.2). The small unincorporated community of Banner Hill is located immediately to the southeast of the NFS facility. The 1990 population within an 80-km (50-mi) radius of the facility was about 949,797 people. The incremental population data within 80 km (50 mi) are available in the license renewal EA (Ref. 1). In the 2000 Census, the four-county region of interest (ROI) around the NFS facility (including Carter, Sullivan, Unicoi, and Washington Counties) had a total population of 334,655. The NFS facility is a significant employer in the region, with a labor force of 653 (Table 3.3), of which 612 live within the ROI.

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" directs Federal agencies to assess whether their programs, policies, or activities have a disproportionate adverse effect on minority and low-income populations. The NRC policy on environmental justice is described in Appendix B of the NRC guidance on environmental review for fuel cycle licensing actions (Ref. 8).

Table 3.2 State and local U.S. Census Bureau 2000 population estimates

Geographic Area/Political Unit	2000 Population	Percent Change from 1990
Unicoi County	17,667	6.8
City of Erwin	5,610	11.8
City of Banner Hill (unincorporated)	1,053	-38.7
State of Tennessee	5,689,283	16.7
Carter County	56,742	10.2
Greene County	62,909	12.7
Sullivan County	153,048	6.6
Washington County	107,198	16.1

Source: U.S. Census Bureau, Quickfacts (http://quickfacts.census.gov/qfd/states).

Table 3.3 Population and distribution of NFS employees by place of residence for the four-Tennessee county ROI

Geographic Area/ Political Unit	Total Population	NFS Employees by Place of Residence
Carter County	56,742	52
Sullivan County	153,048	44
Unicoi County	17,667	252
Washington County	107,198	264
Total in ROI	334,655	612
Total Employees	—	653

Source: NFS Department of Human Resources (September 14, 2001) in November 9, 2001, Letter from B.M. Moore (NFS) to Director, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission.

Demographic data used in the environmental justice evaluation for the proposed action is provided in Appendix A. These data include information on minority populations in the State of Tennessee, Unicoi County, and within a 1.0-km (0.6-mi) radius of the site. For environmental justice evaluation, a minority is defined as an individual classified by the U.S. Census Bureau as being of (i) African-American, (ii) Native American, (iii) Asian, (iv) Native Hawaiian or Other Pacific Islander; or (v) Hispanic or Latino origin. For this evaluation, low-income is below the U.S. Census Bureau poverty level, defined for 2000 at about $17,500 for a household of four (Ref. 9). According to NRC guidance (Ref. 8), if the site area percentage for either minority or low-income populations is greater than the state or county percentages by 20 percent or more, the site has the potential for environmental justice concerns.

All or part of three Unicoi County census block groups are located within 1.0 km (0.6 mi) of the site. Year 2000 Census estimates of racial characteristics are available for these census blocks (Table A–1, Appendix A); however, household income information is not yet available. As a result, model projections from 1998 for Unicoi County are given in Appendix A, Table A–2. The 1990 median household incomes for Tennessee, Unicoi County, and a 1.6-km (1-mi) radius around the facility were $24,807, $20,536, and $22,234, respectively (Ref. 1). This information, when considered with the data in Tables A–1 and A–2, indicates the percentage of minority and low-income populations around the site is similar to the percentages for the State of Tennessee, Unicoi County, or the surrounding counties. Therefore, the proposed action does not appear to pose a disproportionate adverse impact for minority or low-income populations in the vicinity of the NFS facility.

3.4 Land

3.4.1 Areas Adjacent to the Site

The area adjacent to the site consists primarily of residential, industrial, and commercial areas, with a limited amount of farming to the northwest (Table 3.4) (Ref. 1). Privately owned residences are located to the east and south of the facility. Tract size is relatively large, leading to a low housing density in the areas adjacent to the facility. The CSX railroad right-of-way is parallel to the western boundary of the site. Industrial development is located adjacent to the

Table 3.4 Housing units in Unicoi County

Housing Unit	Number	Percent
Occupied Housing Units	7,516	91.5
Vacant Housing Units	698	8.5
Total Housing Units	8,214	100.0
Homeowner Vacancy Rate (percent only)	—	1.0
Rental Vacancy Rate (percent only)	—	6.5

Source: U.S. Census Bureau 2000, Summary File 1 (SF 1) 100-Percent Data, American Factfinder (http://factfinder.census.gov).

railroad on the opposite side of the right-of-way. The site is bounded by Martin Creek to the north, with privately owned, vacant property and low-density residences. Housing data for Unicoi County are summarized in Table 3.4.

3.4.2 Historic Significance

Three sites in Unicoi County are listed on the National Register of Historic Places. There are no National Historic Landmarks listed for Unicoi County, Table 3.5 includes the names of the sites, their location, and the date of their listing on the National Register. The site closest to the NFS facility is the Carolina, Clinchfield, and Ohio Railway Depot, about 2 km (1.2 mi) to the northeast. These sites were previously listed in the NFS license renewal EA (Ref. 1). No additional sites have been listed since 1999. A consultation with the Tennessee Historical commission (Ref. 15) verified that there are no National Register or Historic Places listed or eligible properties affected by this project.

3.4.3 Floodplains and Wetlands

The northern portion of the NFS Erwin Plant is located within the 100-year flood plain of the Nolichucky River and Martin Creek (Ref. 1). Site development and related activities over the past 33 years have modified the topography to protect the site in the event of a 100-year flood (Ref. 2). A significant flood of the Nolichucky River in 1977 (92 percent of greatest recorded flow) did not result in flooding of buildings on the NFS site (Ref. 2). Recent analysis of the Martin Creek flood plain, which incorporated the 1990 culvert enlargement at the CSX

Table 3.5 Places in Unicoi County listed on the National Register of Historic Places

Site Name	Location	Date Listed
Clarksville Iron Furnace	SW of Erwin off Tennessee Route 107 in the Cherokee National Forest	06/04/1973
Carolina, Clinchfield, and Ohio Railway Depot	Intersection of Nolichucky Avenue and Union Street, Erwin	06/22/1993
Tilson Farm; Guinn Farm; Brown Farm	242 Little Branch Road, Flag Pond	06/17/1994

Source: U.S. National Park Service, National Register Information System, (http://www.cr.nps.gov/nr/research/).

rail yard, indicated a small increase in the 100-year base flood elevation of 0.12 m (0.40 ft) (Ref. 3; Ref. 10). The updated map from this analysis indicates the flood plain boundary is now at the northern wall of the proposed BPF (Building 333). The proposed location of the BLEU Complex is not in the 100-year flood plain (Ref. 4).

Based on the review of the National Wetlands Inventory (Ref. 11), no natural wetlands have been mapped in the area. An 8.1×10^{-4}-km^2 (0.2-acre) wetland exists inside the NFS protected area, which is being eliminated by remediation efforts. To offset this wetland removal, another wetland located outside and to the north of the NFS protected area is being increased by 1.6×10^{-3} km^2 (0.4 acres), bringing the total wetland area (marshes/shrub swamps) on NFS property to approximately 6.1×10^{-3} km^2 (1.5 acres) (Ref. 2; Ref. 3).

3.5 Geology, Mineral Resources, and Seismicity

3.5.1 Geology and Soils

The NFS site is located in the Valley and Ridge physiographic province of northeastern Tennessee. This province consists of a series of north-eastern trending valleys and ridges. Faulting and folding produces this series of alternating valleys and ridges by positioning rock units resistive to erosion next to rock units less resistive. The less resistive rock units are eroded by steams to form valleys that are bounded by ridges underlain by more resistant units. Three dolomitic formations (the Shady, Knox and Honaker Formations) and a large band of sandstone, siltstone, shale, dolomite, and limestone called the Rome formation underlie the valley where the NFS site is located. Large portions of the bedrock are covered by deep soils and alluvium (Ref. 2).

3.5.2 Mineral Resources

The principal mineral resources for the NFS area are sand and gravel, metallurgical manganese, and iron ore. The manganese is contained in the residual soils of the Shady Dolomite, Honaker, and lower portions of the Rome Formation. The mining of manganese first began at the end of Word War 1. Large scale mining of sand and gravel for construction purposes ended in the mid-1970s, while the mining of iron ore occurred prior to World War 1 (Ref. 2).

3.5.3 Seismicity

NFS is located in the Southern Appalachian Tectonic Belt. The belt has a moderate level of historical and recent earthquake activity. Specific earthquakes are not associated with known faults near the NFS site. The faults at the NFS site and in the surrounding region show no evidence of geologically recent fault displacement that would be associated with capable faults. A peak ground acceleration of 0.6 m/s^2 (0.06G) with a return period of 1,000 years was calculated for the site (Ref. 3).

3.6 Hydrology

3.6.1 Surface Water

Four main surface water bodies located in the vicinity of the NFS Erwin site are: Banner Spring Branch, North Indian Creek, Martin Creek, and the Nolichucky River. North Indian Creek is located north of the site boundary. The channel of Banner Spring Branch is completely man-made and lies entirely within the NFS site. Based on 16 stream flow measurements made at four different locations on Banner Spring Branch in May/June 1988, the average flow rate is 0.019 m^3 per second (302 gallons per minute) (Ref. 12). Martin Creek flows parallel to the northern property line; the flow rate varies seasonally from 0.063 to 0.32 m^3 per second (1,000 to 5,000 gallons per minute) (Ref. 13). The Nolichucky River flows along the western side of the NFS Erwin Plant; the Embreeville USGS gauge station, which is 3.5 km (2.2 mi) downstream of Outfall 001, reports 39.0 m^3 per second (1376 ft^3 per second) to be the 80-year average river flow rate (Ref. 14). The nearest public water intake is 12.6 km (7.8 mi) downstream of Outfall 001 in the town of Jonesborough, Tennessee (Ref. 2; Ref. 3). The current capacity of the Jonesborough water treatment facility is 15 thousand m^3 (4 million gal) per day, with plans to expand to 30 thousand m^3 (8 million gal) per day by the end of 2002. When the expansion occurs, a second water intake will be located 0.8 km (0.5 mi) closer to the NFS Erwin Plant than the original intake (Ref. 3).

3.6.2 Groundwater

The groundwater system beneath the NFS Erwin site is in the Rome Formation. Shallow groundwater occurs in an unconsolidated alluvial aquifer overlying bedrock. The upper zone of the alluvial aquifer is referred to as the shallow alluvium zone, and the lower zone is the cobble and boulder zone. Bedrock underlying these zones includes the shallow bedrock zone of the bedrock aquifer. The shallow bedrock zone occurs below the alluvial aquifer between 15 and 37 m (50 and 120 ft) below the land surface across the main portion of the site; in the immediate vicinity of the BLEU Complex, it occurs between 6 and 34 m (20 and 113 ft) below the land surface. The thickness of the shallow alluvium zone ranges from about 1.5 to 5.8 m (5 to 19 ft) across the facility and in the vicinity of the proposed BLEU Complex. The cobble and boulder zone ranges in thickness from about 0.2 to 5.2 m (0.7 to 17 ft) across the facility, and 1.5 to 3.0 m (5 to 10 ft) in the vicinity of the proposed BLEU Complex. The maximum thickness is located along the northern edge of the NFS burial ground near Martin Creek. The saturated thickness of this unit ranges up to 4 m (13 ft) in the vicinity of the NFS Burial Ground (Ref. 12). The depth to the water table ranges from about 2.7 to 4.3 m (9 to 14 ft) across the main portion of the site, and 6 to 8 m (20 to 28 ft) in the immediate vicinity of the BLEU Complex. Primary recharge to this aquifer is from rainfall infiltration from the ground surface and upward seepage from the underlying shallow bedrock aquifer. A secondary local source of groundwater recharge is seepage from the floors of ponds, marshes, and streambeds (Ref. 12). The occurrence and yield of groundwater from the Rome aquifer is primarily a function of fracture occurrence. Yields from NFS wells completed in the Rome aquifer have varied from 3.2E-4 m^3 per second (5 gallons per minute) in the cobble and boulder zone and up to 0.019 m^3 per second (300 gallons per minute) in the shallow bedrock zone when a well has intersected a water-bearing fracture.

The overall direction of groundwater flow beneath the NFS Erwin site is toward the western plant boundary and the Nolichucky River. Groundwater flow to the northwest is influenced by the topography that slopes to the northwest and by localized recharge to the overlying alluvial layer at upgradient locations along the valley wall. The hydraulic gradient of the water table ranges from 0.007 to 0.06, with an average gradient of 0.015 in the area of the ponds and the facility. The vertical hydraulic gradient has been determined from water levels measured in clustered wells completed in different zones. Based on these data, a transition occurs beneath most of the facility at a depth of 12 to 15 m (40 to 50 ft) from downward vertical flow throughout the upper portion of the alluvial aquifer to upward vertical flow in the lowermost portion of the alluvial aquifer (Ref. 12). A groundwater contour map for hydraulic head in the shallow alluvium zone is shown in Figure 3.2. The overall slope of the water table is disrupted by Banner Spring Branch near Ponds 1–3, and beneath the central portion of the plant (Ref. 12).

A hydrogeologic investigation has been performed by NFS to determine soil and rock characteristics, variations in groundwater levels, groundwater occurrence, and groundwater/surface-water relationships (Ref. 12). Seventy-four active groundwater monitoring wells/piezometers are completed on or around the NFS Erwin site to depths ranging from about 2.7 to 37 m (9 to 120 ft). Three monitored depth strata coincide with the three aforementioned groundwater zones (i.e., shallow alluvium zone, cobble and boulder zone, and shallow bedrock zone). See Section 4 for additional information on groundwater monitoring wells. A new baseline survey will be conducted in the vicinity of the proposed BLEU Complex site in June 2002 (Ref. 15). As part of this baseline characterization, three monitoring wells will be installed, including one upgradient and two downgradient wells. Soil samples will be obtained at various depths during drilling, and one sample from each boring will be analyzed for chemical and radiological constituents. After the wells are installed, groundwater samples will be obtained and analyzed for gross alpha, gross beta, and gamma isotopic activities.

Municipal water supplies in the vicinity of the NFS Plant include groundwater. Groundwater users in Unicoi County consume approximately 8.6 thousand m^3 (2.3 million gal) per day (Ref. 16). Erwin Utilities uses a combination of wells and springs for its water supply (Ref. 17). While the capacity of Erwin Utilities is 7.2 thousand m^3 (1.9 million gal) per day, its average daily use is 6.4 thousand m^3 (1.7 million gal) per day (Ref. 18). Domestic water supplies generally obtain water from the alluvium and shallow bedrock (Ref. 19). Six public and two private groundwater supply wells exist within a 4.8-km (3.0-mi) radius of the site. The nearest public withdrawal well, the Railroad Well, is about one-half mile north of the NFS Erwin Plant boundary (Ref. 17). Groundwater modeling for the site predicts that neither this well, nor any of the other public water supply wells are directly downstream of the site and therefore would not be affected by site operations at NFS (Ref. 17). Two privately-owned wells and one spring are located north-northwest of the NFS Plant, across the Nolichucky River. Screen depths for these wells are not known. However, the Nolichucky River is a "gaining" river (i.e., it is a water sink with respect to the surrounding hydrologic units, rather than a water source), and it is expected groundwater beneath the NFS Plant is not within the capture zones of either of these wells (Ref. 15).

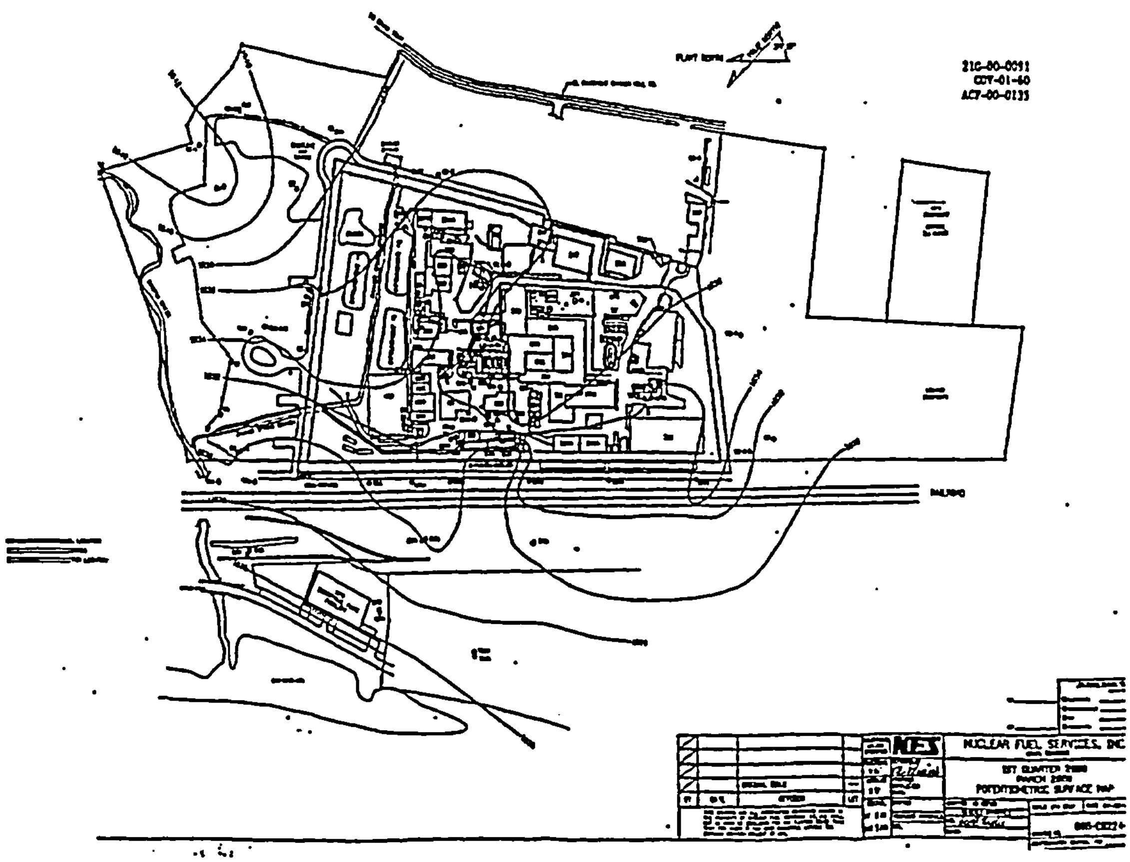

Figure 3.2 Potentiometric surface as measured in the shallow alluvium zone (B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, July 19, 2000)

3.7 Biota

3.7.1 Terrestrial

Terrestrial information summarized by NRC (Ref. 1) for the area surrounding the NFS Erwin Plant remains applicable in 2002. Most of the NFS Erwin Plant site is disturbed (including the proposed BLEU Project site) and covered by plant facilities. NFS (Ref. 4) indicates the proposed site for the BLEU Project was historically used for agricultural purposes and has endured continuous disturbance. The site is described as a grassland (Ref. 3), which was confirmed during an NRC site visit (Ref. 20).

3.7.2 Aquatic

The general aquatic information summarized by NRC (Ref. 1) for the Nolichucky River and several small steams remains applicable in 2002. The Nolichucky River is a typical river of eastern Tennessee with a stream bed composed of rocks, sand, boulders, and some aquatic moss (Ref. 2). This habitat supports smallmouth bass, olive darters, catfish, largemouth bass, spotted bass, central stonerollers, and white crappie (Ref. 1).

3.7.3 Threatened and Endangered Species

The summary of threatened and endangered species provided by NRC (Ref. 1) remains applicable in 2002. A field investigation was conducted on the proposed BLEU complex site to determine the absence or presence of rare, threatened, or endangered plants (Ref. 27). The survey focused primarily on the twenty federally listed threatened and endangered plants, but the State of Tennessee listing of rare and endangered vascular plants was also used for this survey. The results of the survey were that none of the plants on the federal or state lists were found to be present on this site, and the proposed actions on this site are not likely to adversely affect state and federally listed rare, threatened, or endangered plant species. The construction site for the BLEU Complex has been previously disturbed (formerly an NFS baseball field) and is unlikely to present a suitable habitat for rare, threatened, or endangered species.

Unicoi County, the area in which the NFS site is located, contains one Federally Endangered mussel species, Appalachian elktoe (Alasmidonta raveneliana) near the confluence of the Nolichucky River and South Indian Creek. Because this is upstream of the confluence of the Nolichucky River and Martin Creek and the NFS site, no impact is expected on this species. Storm water run-off from the BLEU Complex will be monitored and controlled in accordance with a NPDES storm water discharge permit (to be issued prior to NRC/Tennessee Department of Environment and Conservation (TDEC) approval for operation of the facility). No other threatened or endangered species listed on the Federal or State Threatened or Endangered Species List for the Region of Interest are known to potentially reside on the NFS site.

3.8 Background Radiological Characteristics

Naturally occurring background radiation in the Erwin area is from cosmic and terrestrial sources. These sources, along with artificial sources such as consumer products and diagnostic x-rays, produce both external and internal doses, as described below. The data in Sections 3.8.1, 3.8.2, and 3.8.3 are derived from a National Council on Radiation Protection and Measurement report for average exposure in the United States (Ref. 21). As seen in

Table 3.6, the total annual effective dose from such sources to an average member of the public in the United States is about 0.36 mSv (360 mrem). The corresponding dose to a resident of eastern Tennessee is not expected to differ greatly from this value.

3.8.1 External Background Exposure

Ionizing radiation from sources external to Earth can cause dose directly or by interacting with atmospheric gases. Such cosmic sources of gamma- and X-radiation yield an average dose as shown in Table 3.6. Radionuclides in the earth also decay, producing terrestrial external exposure via gamma- and X-radiation (Table 3.6).

3.8.2 Internal Background Exposure

Radionuclides produced by cosmic radiation also contribute about 0.01 mSv (1 mrem) to internal dose through ingestion (e.g., carbon-14). Radionuclides in soil are incorporated into the body, introducing a terrestrial internal exposure source (Table 3.6). The largest contributor to natural background radiation dose is radon, which yields an average annual effective dose equivalent of 2 mSv (200 mrem) in the United States.

Table 3.6 Annual effective dose equivalent to a resident of the United States

Source	Dose, mrem/yr[a]
Natural Radon	200
Cosmic	27
Terrestrial external	28
Terrestrial internal	39
Medical	53
Consumer and travel	11
Occupational	*0.9*
Nuclear Fuel Cycle	<1
Fallout	<1
Miscellaneous	<1
Rounded total	360

[a] To convert mrem to mSv, multiply by 0.01.

Source: T. Cox, U.S. Nuclear Regulatory Commission, Letter to T.S. Baer, Nuclear Fuel Services, Inc., "Finding of No Significant Impact and Environmental Assessment (TAC No. L30873)," January 29, 1999.

3.8.3 Artificial Background Exposure

Artificial sources of background radiation exposures to members of the public include diagnostic x-rays, consumer products, and occupational sources (Table 3.6). On average, such sources yield a dose of less than 0.7 mSv/yr (70 mrem/yr).

3.8.4 Background Radioactivity Measurements

NFS (Ref. 2; Ref. 3) tabulated radionuclide contents for background natural materials that are representative in nature for those potentially affected by the proposed action. Because potential doses to the public from NFS activities are dominated by internal alpha-emitting radionuclides, only gross alpha measurements were reported. Table 3.7 shows average gross alpha measurements for the periods 1990–1995 (Ref. 2) and 1996–2000 (Ref. 3).

3.9 Nature and Extent of Contamination

Operations at the NFS Erwin Plant have resulted in radiological and nonradiological contamination of the environment. Extensive characterization data pertaining to both EPA and NRC regulatory actions is summarized in the license renewal EA (Ref. 1). Contamination summarized in the following sections pertains mostly to areas related to the proposed action.

Table 3.7 Background radioactivity in the vicinity of NFS

Station	Medium	Gross Alpha Activity, 1990–1995 Average	Gross Alpha Activity, 1996–2000 Average
Asheville Highway	ambient air	2.0×10^{-6} pCi/L	3.1×10^{-6} pCi/L
	soil	3.0 pCi/g	15.1 pCi/g
	vegetation	0.6 pCi/g	1.2 pCi/g
Banner Spring Branch upstream	water	2.3 pCi/L	0.49 pCi/L
	sediment	2.5 pCi/g	5.9 pCi/g
Martin Creek upstream	water	2.4 pCi/L	0.64 pCi/L
	sediment	0.9 pCi/g	4.3 pCi/g
Nolichucky River upstream	water	2.2 pCi/L	0.96 pCi/L
	sediment	1.0 pCi/g	5.8 pCi/g
Groundwater, Well 52	water	0.9 pCi/L	0.97 pCi/L

Note: To convert picocuries to becquerels, multiply by 0.037; to convert liters to cubic meters, multiply by 0.0001.

Source: Nuclear Fuel Services, Inc., "Applicants Environmental Report for Renewal of Special Nuclear Material License No. SNM-124," LIC-01-02, December, 1996.

B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "Supplemental Environmental Report for Licensing Actions to support the BLEU Project," November 9, 2001.

Some information was provided by NFS on a site-wide basis and is therefore presented in the manner which it was received with annotations or discussion to indicate relevance to the proposed action.

3.9.1 Soil Contamination

Radiological and chemical contaminants have been identified at a number of locations on the NFS Erwin site. The most extensive soil contamination is located at the North end of the Plant (at the opposite end of the site property from the location of proposed BLEU Project facilities yet in the vicinity of the WWTF that is included in the proposed action). The North Site includes processing buildings and areas used for waste disposal from 1957 to 1978 including ponds and burial sites. NFS has proposed to decommission for unrestricted release the entire North Site area including structures, tanks, ponds, and Banner Spring Branch (Ref. 1). The impoundments in the north site areas are in the process of being decommissioned. NRC staff expect the reduction in source areas resulting from the decommissioning efforts will further limit the potential for contaminants to migrate beyond facility boundaries in the future.

The southwestern portion of the Erwin Plant is where new facilities for the BLEU Project are planned to be constructed. Historically, this area has been outside the NFS high security perimeter and has not been used for processing activities (Ref. 4). NFS has recently reported radiological contamination in the southwest corner of this area. An initial gamma scan of the area detected elevated levels of radiation in the northwest corner of the proposed construction site in an area of approximately 1,072 m^2 (11,540 ft^2) (about 6 percent of total construction site area). Isotopic analysis of soil samples found elevated levels of various isotopes of uranium, thorium, technetium, americium, and plutonium (Ref. 4). A historical evaluation of the area by NFS concluded the contamination originated from storage of process equipment at that location in the late 1960s (Ref. 4). NFS has removed the most highly contaminated soil, leaving residual contamination above background yet below levels established for North Site Decommissioning (equivalent to a 0.25 mSv/yr (25 mrem/yr) dose} (Ref. 4; Ref. 15). A conservative public dose estimate (offsite) from fugitive dust from construction activities involving this residual contamination was low {0.001 mSv (0.01 mrem)} as expected from the mostly alpha emitting radionuclides present. While the expected radiological hazards to construction workers in this contaminated area are expected to be low (Ref. 8), compliance with radiation protection requirements in 10 CFR Part 20 (Ref. 22), and training requirements in 10 CFR Part 19 (Ref. 23) provide confidence that worker and public safety will be maintained during construction activities.

3.9.2 Surface Water and Sediment Contamination

Both radiological and chemical contaminants have been identified in surface waters adjacent to the NFS facility; however, with few exceptions, measurements have not exceeded regulatory limits. Measured radiological contaminants in surface water are below the effluent concentration limits in 10 CFR Part 20 (Ref. 24). Monitoring results for chemical contaminants have shown elevated levels of total recoverable magnesium and nitrate in the past (Ref. 3). As a result, additional monitoring of the storm water outfall in 1998 and 2000 was required to demonstrate compliance with the storm water discharge permit. Subsequent investigation attributed the elevated measurements to natural background soil concentrations greater than permit cutoff concentrations (Ref. 4). While total recoverable zinc is not regulated under the

NPDES permit, it was also shown to be elevated with respect to the National Primary Drinking Water Standards (Ref. 3). Erosion to surface water will be controlled by NFS during construction to limit impacts. Continued monitoring of surface water will ensure any impacts are detected early so appropriate mitigation measures can be taken.

The downstream surface water and sediment sample results from 1990 through 2001 are shown in Table 3.8. Effluents from the BLEU Project will be released to both the Nolichucky River and Martin Creek (see Section 4). Review of the surface water data indicates that the gross alpha activity in downstream water samples from Banner Spring Branch and Martin Creek has increased each year through 1998 and then decreased, while no specific trend was observed in the Nolichucky River data. Review of the sediment data indicates that the gross alpha activity in downstream sediment samples from Banner Spring Branch reached a maximum in 1999 and then decreased. No specific trend was observed for gross alpha activity in downstream sediment samples from Martin Creek. Gross alpha activity in Nolichucky River

Table 3.8 Environmental monitoring results for gross alpha emitters in downstream surface water samples (in pCi/L)[a] and stream-sediment samples (in pCi/g)[a]

	Onsite		Offsite			
	Banner Spring Branch[b]		Martin Creek		Nolichucky River	
Year	Surface Water	Sediment	Surface Water	Sediment	Surface Water	Sediment
1990	8.7	11.4	5.1	0.87	2.1	0.20
1991	8.6	14.6	5.0	4.4	2.8	0.63
1992	11	47.2	5.4	8.0	2.4	0.94
1993	19	48.3	6.5	5.1	1.8	0.94
1994	14	50.8	6.3	12.3	2.7	1.37
1995	15	60.8	7.0	5.9	1.9	1.25
1996	ND	50.0	9.9	2.6	0.38	1.39
1997	ND	59.4	10.8	5.7	0.66	2.79
1998	22.3	92.0 (TBV)	10.4	5.3	0.39	2.40
1999	13.1	95.9 (TBV)	6.6	4.2	1.1	8.75
2000	15.4	60.7	6.3	9.7	2.9	10.84
2001	17.1	55.1	ND	ND	ND	ND

[a] To convert picocuries to becquerels, multiply by 0.037; to convert liters to cubic meters, multiply by 0.001.
[b] This location is onsite, but is outside of the NFS protected area.

ND = No data
TBV = To be validated

Sources: Nuclear Fuel Services, Inc., "Applicants Environmental Report for Renewal of Special Nuclear Material License No. SNM-124," LIC-01-02, December, 1996.

B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "Supplemental Environmental Report for Licensing Actions to support the BLEU Project," November 9, 2001.

B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "NFS Responses to NRC's Request for Additional Information to Support an Environmental Review for the BLEU Project," March 15, 2002.

sediments shows an increasing trend beginning in 1999, which may be related to earthmoving associated with decommissioning activities. The highest measured sediment concentration of gross alpha activity in 2000, 0.401 Bq/g (10.84 pCi/g) was less than a factor of two above reported background concentrations at an upstream location (Ref. 3).

3.9.3 Groundwater Contamination

Groundwater contamination from past activities at the NFS Plant has been detected at a number of locations (Ref. 1). The environmental impacts from existing contamination have been previously addressed in 1999 by NRC in the EA for renewal of the NFS license (Ref. 1).

Available information is summarized here to establish current baseline conditions at locations associated with the proposed BLEU Project activities, including areas down gradient from these locations. Groundwater contaminants have been identified in the alluvial and upper bedrock zones and not below the upper bedrock (Ref. 24). The proposed BLEU Project activities will be conducted in three areas of the NFS Plant: (i) the proposed site for the BLEU Complex, (ii) Building 333 (formerly Building 301), and (iii) at the NFS WWTF. Groundwater underlies all three processing areas.

There are no known plumes of groundwater contamination beneath the site of the proposed BLEU Complex, and no wells are routinely monitored in that area. No significant uranium contamination has been found in the groundwater beneath Building 333; however, a uranium plume immediately borders the eastern corner of this building (Figures 3.3 and 3.4). Elevated localized uranium contamination {up to 11.4 kBq/m^3 (308 pCi/L)} has been measured near buildings adjacent to Building 333 (i.e., Buildings 120, 130, and 131); however, site boundary wells indicate migration offsite has not occurred (Ref. 5). Monitoring wells at the site boundary and in the path of groundwater flow originating below Building 333 provide confidence that potential migration of localized contamination from this location to off-site groundwater could be identified. Due to the predominant groundwater flow, any breach of containment from Building 333 would add to the groundwater contamination in the area. Use of appropriate engineering controls (e.g., storage tank level controls and dikes) as described in Attachment III of the RAI response letter (Ref. 4) is expected to significantly reduce the potential for loss of containment from the proposed action that could further contaminate groundwater. Detailed information on accident potentials will be provided in a forthcoming NFS integrated safety assessment.

Groundwater near the NFS WWTF and Monitoring Well 38 (now abandoned) has localized ^{99}Tc contamination. Technetium-99 contamination of the groundwater is summarized in Table B–1 (Appendix B). Analyses of ^{99}Tc levels indicate contamination is localized because the detection limit {3.0 kBq/m^3 ((80 pCi/L)} has not been exceeded in either the boundary wells or in the off site wells (Ref. 5). A uranium plume and plumes of nonradiological constituents also exist in the vicinity of the NFS WWTF, due to its close proximity to the surface impoundment source area. High localized groundwater concentrations of uranium (up to 1,223 kBq/m^3 (33,059 pCi/L)} and technetium have been identified near the surface impoundments (Ref. 5), however, boundary wells indicate no migration offsite. Removal of source contamination from decommissioning the surface impoundments suggests concentrations are unlikely to increase in the future.

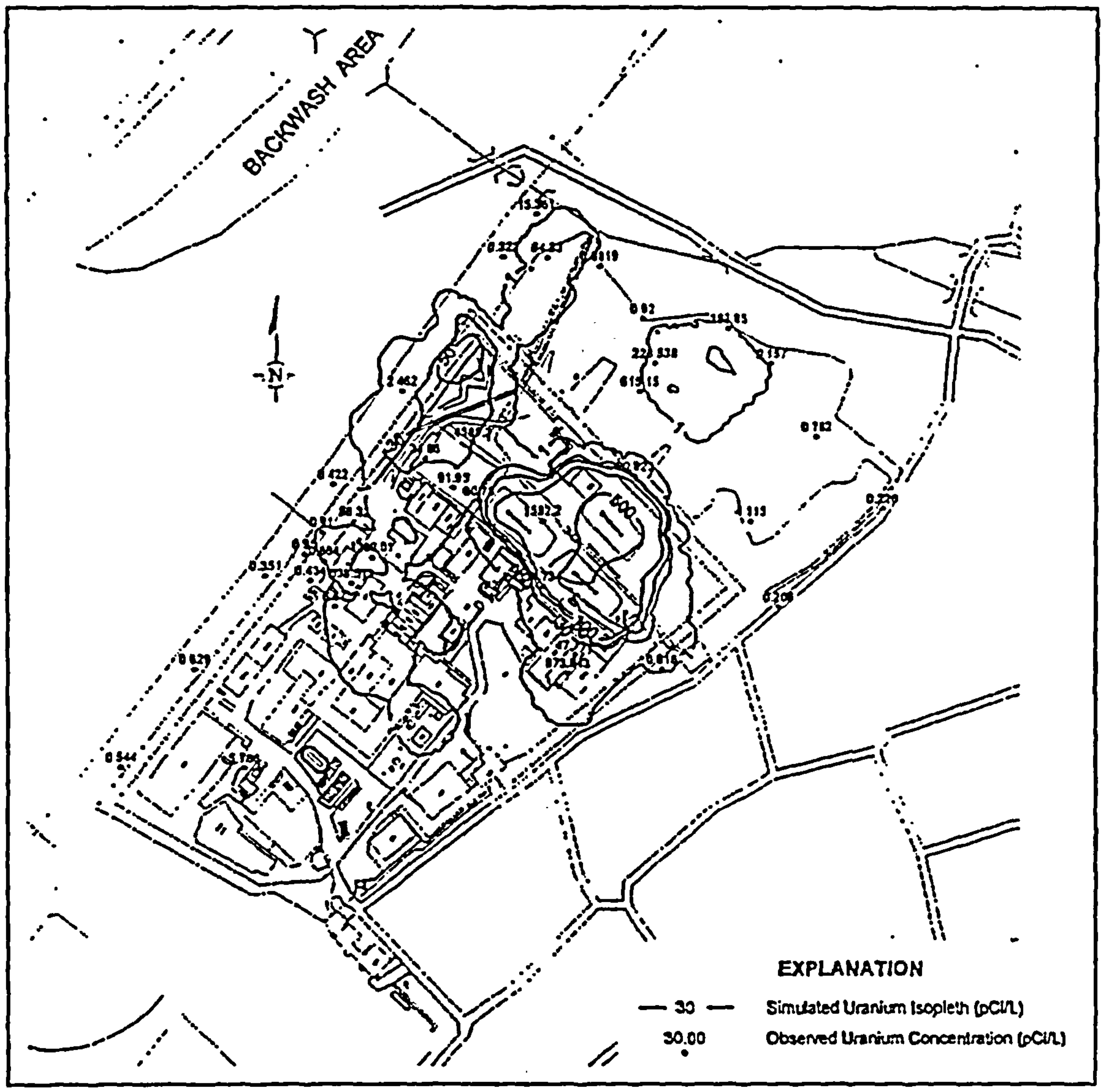

Figure 3.3 Contaminant isopleth map of uranium in the shallow alluvium zone (Ref. 3)

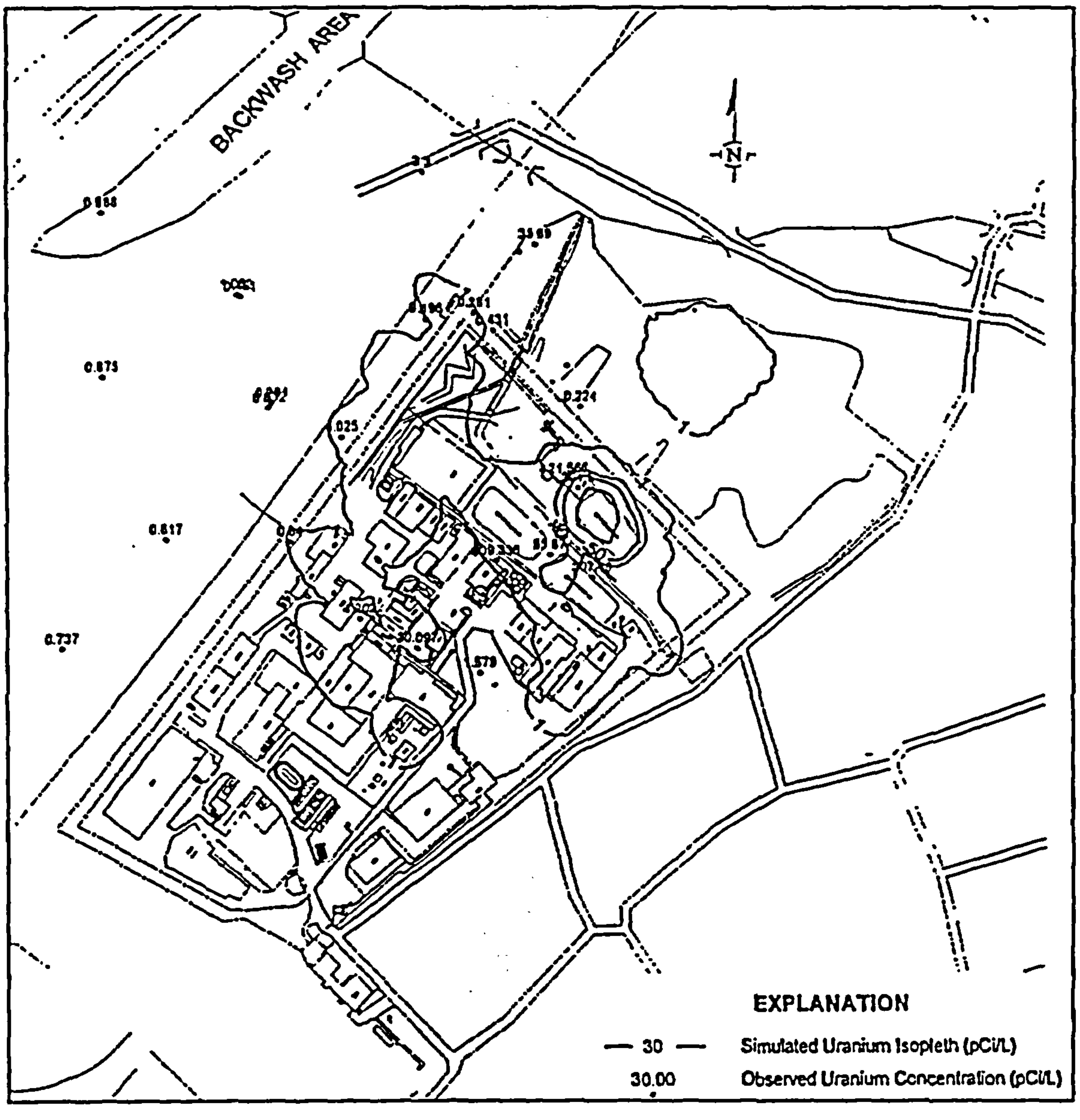

Figure 3.4 Contaminant isopleth map of uranium in the cobble/boulder zone (Ref. 3)

The surface impoundments create an artificial recharge zone. Therefore, the primary groundwater path for any release from the WWTF is likely vertically downward within the aquifer to a depth of at least 12 to 15 m (40 to 50 ft), and then horizontally toward the Nolichucky River (Figure 3.2). Monitoring wells at the site boundary in the path of groundwater flow originating in the vicinity of the surface impoundments provide confidence that potential localized releases to groundwater from the WWTF could be identified. Due to the predominant groundwater flow, any breach of containment from the WWTF would add to the groundwater contamination in the area. Detailed information on accident potentials will be provided in a forthcoming NFS integrated safety assessment.

Background chemical data from an upgradient well indicates that average concentrations of monitored chemicals (chloride, fluoride, mercury, nitrate, phosphorus, sulfate, and tetrachloroethylene) have decreased since 1996, except for tetrachloroethylene, which has increased. With the exception of tetrachloroethylene, pre- and post-1996 background concentrations were below water quality benchmark standards (Ref. 2; Ref. 3). The upgradient tetrachloroethylene source is undetermined (Ref. 3); tetrachloroethylene concentrations increased downgradient, and modeling efforts indicate that the region of the tetrachloroethylene plume exceeding the EPA maximum contaminant level for drinking water extends down gradient and offsite as far as the industrial park properties (Ref. 13). More recent groundwater models indicate that the tetrachloroethylene plume is at steady state, and that its size should gradually decrease through natural biodegradation, with or without remediation (Ref. 24). Other nonradiological constituents, such as trichloroethylene, 1,2-dichloroethylene, vinyl chloride, tributyl phosphate, and bis (2-ethylhexyl) phthalate, exceed the EPA maximum contaminant levels for drinking water at downgradient locations. Aroclor-1254 was the only polychlorinated biphenyl above drinking water standards. Metals detected above the drinking water standard include antimony, lead, and mercury (Ref. 26). Total petroleum hydrocarbons, fluoride, nitrates, and sulfates were also above the EPA drinking-water standards.

3.10 References for Section 3

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4. EFFLUENT AND ENVIRONMENTAL MONITORING PROGRAM

The NFS Erwin Plant conducts effluent and environmental monitoring programs to evaluate potential public health impacts and comply with the NRC effluent and environmental monitoring requirements. The effluent program monitors the airborne, liquid, and solid waste streams produced during operation of the NFS Plant. The environmental program monitors the air, surface water, sediment, soil, groundwater, and vegetation in and around the NFS Plant. This section describes the proposed effluent and environmental monitoring program for the BLEU Project.

4.1 Effluent Monitoring

Airborne, liquid, and solid effluent streams that contain radioactive material are generated at the NFS Plant and monitored to ensure compliance with NRC regulations in 10 CFR Part 20 (Ref. 1). Section 2 provides details regarding specific effluent streams from the proposed action. BLEU Project effluent streams will be sent to existing and new facilities. The current effluent monitoring program for radiological material at existing facilities is summarized in Table 4.1. The radiological effluent monitoring program for new facilities is summarized in Table 4.2. Each effluent is monitored at or just before the point of release. The results of effluent monitoring are reported on a semi-annual basis to the NRC in accordance with 10 CFR 70.59. Airborne and liquid effluents are also monitored for nonradiological constituents (Ref. 2) in accordance with state discharge permits. For the purpose of this EA, the state of Tennessee is expected to set limits on effluents under its regulatory control that are protective of health and safety and the local environment.

4.1.1 Airborne Effluent Monitoring

Radiological and nonradiological airborne effluents from the BLEU Project (Section 2) will be treated and released to the environment through stacks. Effluent air emissions from the BPF will be discharged through the existing main NFS stack (Stack No. 416) (Ref. 2). Air monitoring for the main stack is described in the license renewal ER (Ref. 3). Effluent air emissions from the BLEU Complex will be discharged from new stacks on the OCB, UNB, and EPB. The stack locations for the BLEU Complex are shown in Figure 2.2.

The airborne effluents will be monitored for nonradiological constituents in accordance with several operating permits issued by the Tennessee Air Pollution Control Board, Department of Environment and Conservation. NFS is requesting modification to the existing air pollution control permit for the main stack. Modification of the permit is required due to changes in material input from the BPF and installation of additional process and ventilation equipment. This modified permit for the main stack has not been issued as of this EA. NFS is requesting a new permit for the BLEU Complex emissions. This permit for the BLEU Complex has not been issued as of this EA. Section 2.1.3 provides additional details regarding proposed effluents. The NRC approval of the three license amendments to conduct operations will be contingent upon NFS obtaining these permits.

Table 4.1 Current radiological effluent monitoring program at the NFS Erwin Plant

Effluent	Sample Type/Collection Frequency	Radionuclide Minimum Detectable Concentration[a]	Radionuclide Action Level[a]	Required Action
Gaseous Effluent:				
Main Processing Stack	Continuous/Daily[b]	Gross Alpha 8.0×10^{-14} µCi/mL	Monthly Average: > 2.0×10^{-11} µCi/mL	Notification of Environmental Protection Function Manager; Investigation; Initiation of Corrective Actions
		Gross Beta 1.0×10^{-13} µCi/mL	Monthly Average: > 2.0×10^{-11} µCi/mL	
Combined Releases from Other Uranium Stacks	Continuous/Daily[b]	Gross Alpha 8.0×10^{-14} µCi/mL	Monthly Average: > 2.0×10^{-12} µCi/mL	Notification of Environmental Protection Function Manager; Investigation; Initiation of Corrective Actions
		Gross Beta 1.0×10^{-13} µCi/mL	Monthly Average: > 2.9×10^{-10} µCi/mL	
Combined Releases from Plutonium Stacks (Building 234)	Continuous/ Weekly	Gross Alpha 8.0×10^{-15} µCi/mL	Monthly Average: > 7.0×10^{-13} µCi/mL	Notification of Environmental Protection Function Manager; Investigation; Initiation of Corrective Actions
		Gross Beta 1.0×10^{-14} µCi/mL	Monthly Average: > 1.9×10^{-12} µCi/mL	
Liquid Effluent:				
Waste Water Treatment Facility	Grab/Each Batch	Gross Alpha 1.5×10^{-7} µCi/mL	Each Batch > 3.0×10^{-7} µCi/mL	Notification of Environmental Protection Function Manager; Investigation; Initiation of Corrective Actions
		Gross Beta 3.0×10^{-7} µCi/mL	Monthly Average: > 6.0×10^{-5} µCi/mL	
	Composite/ Monthly	Isotopic Uranium	Sample SOF > 1.0[c]	
Sanitary Sewer Discharges	Continuous/ Daily[b]	Gross Alpha 1.5×10^{-8} µCi/mL	Each Batch > 3.0×10^{-7} µCi/mL	Notification of Environmental Protection Function Manager; Investigation; Initiation of Corrective Actions
		Gross Beta 3.0×10^{-8} µCi/mL	Each Batch > 6.0×10^{-6} µCi/mL	
	Composite/ Monthly	Isotopic Uranium	Sample SOF > 0.5[c]	

[a] To convert µCi/mL to Bq/m^3, multiply by 3.7E+10.
[b] Daily means normal 5-operating day work week. On holidays and weekends samplers will continue to accumulate samples; however, the sample will not be collected until the next normal operating day.
[c] SOF = Sum of fractions for the mixture of radionuclides. The SOF is determined by summing the ratios of each nuclide concentration to the applicable effluent concentration limit in Appendix B, Table 2, Column 2 of 10 CFR Part 20.

Source: Nuclear Fuel Services, Inc., "Revisions to Chapter 5 of License Renewal Application," Docket No. 70-143, August 28, 1998.

Nuclear Fuel Services, Inc., "Responses to NRC Request for Additional Information to Complete Environmental Review for License SNM-124 (TAC No. L30873), Dated 11/26/97," Docket No. 70-143, February 4, 1998.

Table 4.2 Proposed radiological effluent monitoring program for the BLEU Complex

Effluent	Sample Type/Collection Frequency	Radionuclide Minimum Detectable Concentration[a]	Proposed Radionuclide Action Level[a]	Required Action
Gaseous Effluent:				
Uranyl Nitrate Building	Continuous/Daily[b]	Gross Alpha 8.0×10^{-14} µCi/mL	Monthly Average: $> 2.0 \times 10^{-11}$ µCi/mL	Notification of Environmental Protection Function Manager; Investigation; Initiation of Corrective Actions
		Gross Beta 1.0×10^{-13} µCi/mL	Monthly Average: $> 2.9 \times 10^{-10}$ µCi/mL	
Oxide Conversion Building	Continuous/Daily[b]	Gross Alpha 8.0×10^{-14} µCi/mL	Monthly Average: $> 2.0 \times 10^{-11}$ µCi/mL	Notification of Environmental Protection Function Manager; Investigation; Initiation of Corrective Actions
		Gross Beta 1.0×10^{-13} µCi/mL	Monthly Average: $> 2.9 \times 10^{-10}$ µCi/mL	
Effluent Processing Building	Continuous/Daily[b]	Gross Alpha 8.0×10^{-14} µCi/mL	Monthly Average: $> 2.0 \times 10^{-11}$ µCi/mL	Notification of Environmental Protection Function Manager; Investigation; Initiation of Corrective Actions
		Gross Beta 1.0×10^{-13} µCi/mL	Monthly Average: $> 2.9 \times 10^{-10}$ µCi/mL	
Liquid Effluent:				
Sanitary Sewer Discharge	Proportional/ Daily[c]	Gross Alpha 1.5×10^{-8} µCi/mL	Each Batch $> 3.0 \times 10^{-7}$ µCi/mL	Notification of Environmental Protection Function Manager; Investigation; Initiation of Corrective Actions
		Gross Beta 3.0×10^{-8} µCi/mL	Monthly Average: $> 6.0 \times 10^{-6}$ µCi/mL	
	Composite/ Monthly	Isotopic U, Th, Pu, and Tc-99	Sum of Fraction > 0.5	

[a] To convert µCi/mL to Bq/m³, multiply by 3.7E+10.

[b] Sample exchange frequencies will be established by NFS and Framatone ANP Inc. to ensure that the measurement sensitivity criteria are met. Daily sample frequency based on information from Nuclear Fuel Services, "NFS Response to NRC's Request for Additional Information to Support an Environmental Review for the BLEU Project," Docket No. 70-143, March 15, 2002.

[c] Daily means normal 5-operating day work week. On holidays and weekends samplers will continue to accumulate samples; however, the sample will not be collected until the next normal operating day.

Source: Nuclear Fuel Services, Inc., "Additional Information to Support an Environmental Review for BLEU Project," Docket No. 70-143, January 15, 2002.

4.1.2 Liquid Effluent Monitoring

Liquid effluents released from the BLEU Project will contain both radiological and nonradiological materials (Section 2). The proposed BPF and BLEU Complex will have separate liquid waste streams. Liquid effluents from the BPF will be processed at the NFS WWTF. Liquid effluents from the BLEU Complex will exit the NFS Erwin Plant by the sanitary sewer to the Erwin Publicly Owned Treatment Works, and storm water run-off will exit to Martin Creek.

Monitoring of the WWTF is as stated in the license renewal EA (Ref. 3). The WWTF releases treated liquid effluent in batches into the Nolichucky River at outfall 001. Liquid effluent release locations are shown in Figure 4.1. NPDES permit limits for nonradiological constituents in the WWTF discharge at outfall 001 are provided in Table C–1 (Appendix C). Previously, the WWTF has treated liquid effluent generated from downblending operations that occurred in the 200 Complex. The radiological and nonradiological constituents associated with proposed BPF operation will be similar to previous downblending operations from the 200 Complex. No changes will be required in the NPDES permit or monitoring program, because the BPF liquid effluent will not add any new process chemicals to the system, and the additional throughput will not exceed permitted discharge limits (Ref. 4).

4.1.3 Sewer and Storm Water Monitoring

Liquid effluents from the BLEU Complex discharged to the sanitary sewer will be monitored for both radiological and nonradiological constituents in accordance with a pre-treatment permit from Erwin Utilities Publically Owned Treatment Works. Monitoring of liquid effluents currently discharged to the sanitary sewer is as stated in the license renewal EA (Ref. 3). A proportional sampler at the lift station will serve as the monitoring location for liquid effluent discharged from the BLEU Complex to the sewer. Location of the sewer lift station monitoring point is shown in Figure 2.2. Appendix C, Table C–2 summarizes the current Publicly Owned Treatment Works permit limits for the sanitary sewer discharge. NFS will request a separate Erwin Publicly Owned Treatment Works pre-treatment permit for the BLEU Complex (Ref: 2).

Storm water monitoring for the BLEU Complex will be conducted in accordance with a general NPDES storm water discharge permit. Location of the storm water monitoring point for the BLEU Complex is shown in Figure 2.2. While NFS currently maintains an NPDES storm water discharge permit, this permit will not be modified. A separate storm water permit will be obtained for the construction and operation of the BLEU Complex (Ref. 4).

4.1.4 Solid Waste

Solid wastes generated by BLEU Project operations will be packaged into drums or boxes. Each container will be assayed for uranium content to verify that storage, shipment, and disposal requirements are met.

4.2 Environmental Monitoring

NFS conducts a sampling program of ambient air, soil, vegetation, surface water, sediment, and groundwater to monitor impacts from the Erwin Plant to the surrounding area. The current

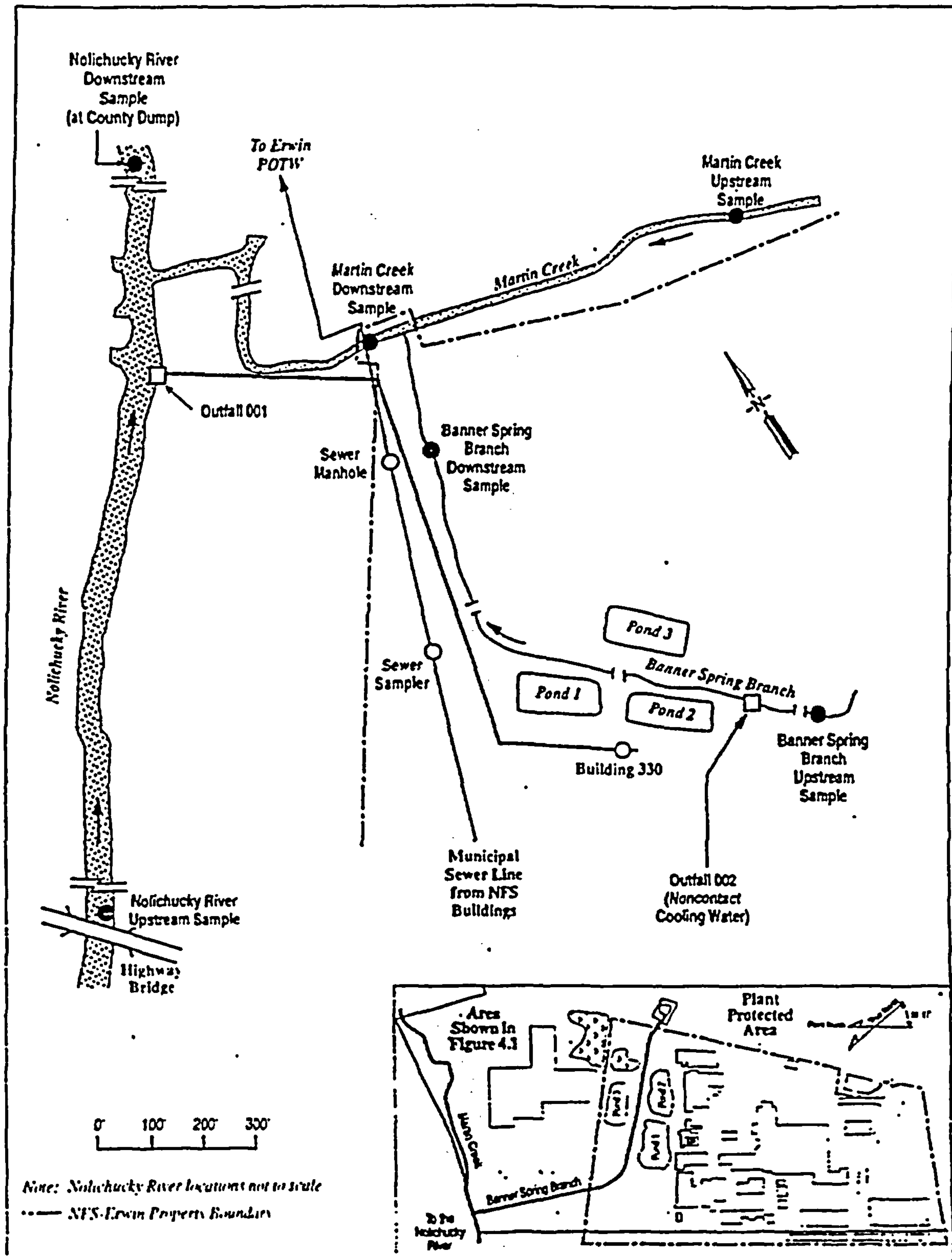

Figure 4.1 Liquid-effluent monitoring locations (B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "Clarification of NFS Responses to the RAI Supporting NRC's Environmental Review for the Bleu Project," April 12, 2002.)

environmental monitoring program for radiological material is summarized in Table 4.3. Details of the monitoring program are described in the license renewal EA (Ref. 3). Environmental monitoring locations are shown in the license renewal EA (Ref. 3), and historical monitoring results are provided in Appendix D. Groundwater monitoring well locations are shown in Figure 4.2 and additional details of the groundwater monitoring program are provided in Table 4.4. The groundwater monitoring wells at the NFS site (Figure 4.2) serve a variety of regulatory purposes. For the environmental monitoring program, the current NFS license requires routine monitoring of 11 wells (52, 98A, 99A, 100A, 100B, 101A, 102A, 103A, 104A, 105A, and 106A).

The addition of the BLEU Complex will expand the physical site of the Erwin Plant. Current environmental monitoring stations do not provide adequate coverage of the expanded site area. As shown in Figure 12 of the license renewal ER (Ref. 5), no air, vegetation, or soil monitoring stations are located to the immediate east, west, or south of the BLEU Complex (except for the background sampling station); however, winds frequently blow to the south as identified in Figure 7 of the license renewal ER (Ref. 5). In addition, the current monitoring program lacks adequate coverage for groundwater in the vicinity of the proposed BLEU Complex. NFS plans to expand the existing environmental monitoring program to cover the BLEU Complex (Ref. 4). Additional monitoring locations (e.g., air, vegetation, soil, groundwater) will be proposed in a forthcoming license amendment request for the BLEU Project (Ref. 4). For groundwater monitoring, NFS has indicated a minimum of one upgradient and three downgradient wells will be installed in the vicinity of the proposed BLEU Complex (Ref. 4). NRC review of the proposed environmental monitoring program to determine compliance with 10 CFR Part 20 (Ref. 1) requirements provides assurance that an adequate program will be in place prior to making a decision on the license amendments.

4.3 References for Section 4

1. U.S. Code of Federal Regulations, "Standards for Protection Against Radiation," Part 20, Chapter 1, Title 10, *Energy*.

2. B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "Supplemental Environmental Report for Licensing Actions to support the BLEU Project," November 9, 2001.

3. T. Cox, U.S. Nuclear Regulatory Commission, Letter to T.S. Baer, Nuclear Fuel Services, Inc., "Finding of No Significant Impact and Environmental Assessment (TAC NO. L30873)," January 29, 1999.

4. B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "NFS Responses to NRC's Request for Additional Information to Support an Environmental Review for the BLEU Project," March 15, 2002.

5. Nuclear Fuel Services, Inc., "Applicants Environmental Report for Renewal of Special Nuclear Material License No. SNM-124," LIC-01-02, December, 1996.

Table 4.3 Summary of environmental monitoring program at the NFS Erwin Plant

Sample Medium	Number of Stations	Sample Type/ Collection Frequency	Parameters Analyzed	Action Level (µCi/mL[a] unless otherwise stated)	Typical MDC (µCi/mL[a] unless otherwise stated)
Ambient Air	8			Quarterly Ave	
		Continuous/ Weekly	Gross Alpha Gross Beta	$> 5.0 \times 10^{-15}$ $> 9.0 \times 10^{-11}$	3.0×10^{-15} 1.0×10^{-14}
		Composite/ Quarterly	Isotopic U	Total U $> 5.0 \times 10^{-15}$	4.0×10^{-16}
		Composite/ Annually	Isotopic U Isotopic Pu	Total Th $> 4.0 \times 10^{-16}$ Total Pu $> 2.0 \times 10^{-15}$	1.0×10^{-16} 1.0×10^{-16}
Surface Water					
Banner Spring Branch, Upstream	(see note d)	Grab/Quarterly	Gross Alpha Gross Beta	Sample $> 3.0 \times 10^{-8}$ $> 3.0 \times 10^{-6}$	1.0×10^{-8} 2.0×10^{-8}
Banner Spring Branch, Downstream	(see note d)	Grab/ Quarterly[a]	Gross Alpha Gross Beta	Sample $> 3.0 \times 10^{-7}$ $> 6.0 \times 10^{-6}$	1.5×10^{-8} 3.0×10^{-8}
		Composite/ Monthly	Isotopic U	Sample SOF > 1.0[c]	1.00×10^{-9}
Martin Creek, Upstream	(see note d)	Grab/Quarterly	Gross Alpha Gross Beta	Sample $> 3.0 \times 10^{-8}$ $> 3.0 \times 10^{-6}$	1.0×10^{-8} 2.0×10^{-8}
Martin Creek, Downstream	(see note d)	Grab/Weekly	Gross Alpha Gross Beta	Sample $> 3.0 \times 10^{-7}$ $> 6.0 \times 10^{-6}$	1.5×10^{-8} 3.0×10^{-8}
Nolichucky River, Upstream	(see note d)	Grab/Quarterly	Gross Alpha Gross Beta	Sample $> 3.0 \times 10^{-8}$ $> 3.0 \times 10^{-6}$	1.0×10^{-8} 2.0×10^{-8}
Nolichucky River, Downstream	(see note d)	Grab/Quarterly	Gross Alpha Gross Beta	Sample $> 3.0 \times 10^{-7}$ $> 6.0 \times 10^{-6}$	1.5×10^{-8} 3.0×10^{-8}
Soil	4	Grab/Quarterly	Gross Alpha	Sample > 25 pCi/g[a]	5 pCi/g[a]
Silt/Sediment	(see note c)	Grab/Quarterly	Gross Alpha	Sample > 25 pCi/g	5 pCi/g[a]
Vegetation	4	Grab/Quarterly	Gross Alpha	Sample > 25 pCi/g	5 pCi/g[a]

Table 4.3 Summary of environmental monitoring program at the NFS Erwin Plant (continued)

Sample Medium	Number of Stations	Sample Type/ Collection Frequency	Parameters Analyzed	Action Level (µCi/mL unless otherwise stated)	Typical MDC (µCi/mL unless otherwise stated)
Groundwater	11	Grab/Quarterly	Gross Alpha Gross Beta	Sample > 15 pCi/g Sample > 50 pCi/L	10 pCi/g[a] 15 pCi/L

[a] To convert µCi/mL to Bq/m³, multiply by 3.7E+10; to convert pCi to Bq, multiply by 0.037; to convert L to m³, multiply by 0.001.

[b] Daily means normal 5-operating day work week. On holidays and weekends samplers will continue to accumulate samples; however, the sample will not be processed until the next normal operating day.

[c] SOF = Sum of fractions for the mixture of radionuclides. The SOF is determined by summing the ratios of each nuclide concentration to the applicable effluent concentration limit in Appendix B, Table 2, Column 2 of 10 CFR Part 20.

[d] Sample locations are specified in onsite procedures and are subject to change.

Sources: U.S. Nuclear Regulatory Commission, "Finding of No Significant Impact and Environmental Assessment (TAC No. L30873)," Docket No. 70-143, November 9, 2001, and Nuclear Fuel Services, Inc. Clarification of NFS' Responses to the RAI Supporting NRC's Environmental Review for the BLEU Project," Docket No. 70-143, April 12, 2002.

Table 4.4 Summary of NFS site area groundwater monitoring program

Site Area Monitored[a]	Groundwater Monitoring Wells[a,b]	Radiological Constituents Monitored	Nonradiological Constituents Monitored
Maintenance Shop Area	Model Layer 1: 93[d] Model Layer 2: 97A, 108A, IW-1, OW-1, 111A	U-233, U-234, U-235, U-238	Conductivity, pH, temperature, dissolved oxygen, oxidation-reduction potential, total dissolved solids, ferrous iron, alkalinity, VOCs by 8260, TBP, total organic carbon, dissolved organic carbon, nitrate nitrogen, nitrite nitrogen, ammonia nitrogen, iron, manganese, sulfate, phosphate, carbon dioxide, methane, chloride, ethene, ethane biochemical oxygen demand, chemical oxygen demand
Building 234	Model Layer 1:. 234-2, 234-3	gross alpha, gross beta, (U-233, U-234, U-235, U-238, Pu-238, Pu-239, Pu-242, Th-228. Th-230, Th-232, Tc-99)[c]	Conductivity, pH, temperature, dissolved oxygen, oxidation-reduction potential, TBP, PCE, TCE, 1,2-DCE, VC

Table 4.4 Summary of NFS site area groundwater monitoring program (continued)

Site Area Monitored[a]	Groundwater Monitoring Wells[a,b]	Radiological Constituents Monitored	Nonradiological Constituents Monitored
Burial Ground	Model Layer 1: 52[e], 55, 57, 63, 63A, 95A Model Layer 2: 63B Model Layer 3: 60B, 67, 67B Model Layers 2 and 3: 60	Gross Alpha, Gross Beta, (U-233, U-234, U-235, U-238, Pu-238, Pu-239, Pu-242, Th-228. Th-230, Th-232, Tc-99)[c]	Conductivity, pH, temperature, dissolved oxygen, oxidation-reduction potential, TBP, PCE, TCE, 1,2-DCE, VC
Site Boundary	Model Layer 1: 98A,[e] 99A, 101A[d,e], 103A[d,e] 104A[d,e], 105A[d,e], 106A[d,e] Model Layer 2: 100A,[e] 102A[d,e] Model Layer 3: 100B[e]	Gross Alpha, Gross Beta, (U-233, U-234, U-235, U-238, Pu-238, Pu-239, Pu-242, Th-228. Th-230, Th-232, Tc-99)[c]	Conductivity, pH, temperature, dissolved oxygen, oxidation-reduction potential, TBP, PCE, TCE, 1,2-DCE, VC
Pond Areas	Model Layer 1: 64, P-1[d], P-2[d], P-3[d] Model Layer 2: 38R[d]	Gross Alpha, Gross Beta, U-233, U-234, U-235, U-238, Pu-238, Pu-239, Pu-242, Th-228. Th-230, Th-232, Tc-99	TBP, PCE, TCE, 1,2-DCE, VC
Offsite	Model Layer 2: 116A, 116B, 117A, 117B, 118A, 119A, 120A Model Layer 3: 118B, 120B	Gross Alpha, Gross Beta, (U-233, U-234, U-235, U-238, Pu-238, Pu-239, Pu-242, Th-228. Th-230, Th-232, Tc-99)[c]	Conductivity, pH, temperature, dissolved oxygen, oxidation-reduction potential, TBP, PCE, TCE, 1,2-DCE, VC

[a] Refer to Figure 4.2 for locations of site areas and groundwater monitoring wells.
[b] Groundwater model zones 1, 2, and 3 correspond to shallow alluvium, cobble and boulder, and shallow bedrock *layers, respectively.*
[c] Constituents monitored only if triggered by gross alpha greater than 0.56 kBq/m^3 (15 pCi per liter) or gross beta greater than 1.8 kBq/m^3 (50 pCi per liter).
[d] Monitoring location near a proposed action area.
[e] Included in Environmental Monitoring Program

TBP = tributyl phosphate, PCE = tetrachloroethylene, TCE = trichloroethylene, DCE = dichloroethylene, VC = vinyl chloride

Source: Nuclear Fuel Services, Inc., "Additional Information to Support an Environmental Review for the BLEU Project," January 15, 2002.

Figure 4.2 redacted

5. ENVIRONMENTAL CONSEQUENCES

Implementing the proposed action is not expected to result in significant adverse impacts to the environment. The environmental consequences of the proposed license amendments for the NFS BLEU Project are summarized in Section 5.1. The environmental consequences of the no action alternative (no authorization for license amendments) are described in Section 5.2.

5.1 Environmental Consequences of the Proposed Actions

For the proposed license amendments, construction and processing operations will result in the release of low levels of chemical and radioactive constituents to the environment. Under accident conditions, higher concentrations of materials could be released to the environment over a short period of time. Section 5.1.1 evaluates the impacts of normal operations and Section 5.1.2 evaluates the impacts of postulated accidents. Accident impacts are considered only at a general level of detail for this EA. Detailed accident analyses (an integrated safety assessment) will be provided by NFS in a forthcoming license amendment request related to the BLEU Project. NRC review of these analyses to ensure compliance with the performance requirements in 10 CFR Part 70 (Ref. 1) will ensure all important accident scenarios and consequences are evaluated prior to a decision on the amendment requests. Section 5.1.3 discusses cumulative impacts.

5.1.1 Normal Operations

Normal operations will involve discharges to the atmosphere and to surface water. The impacts of normal operations are discussed below.

5.1.1.1 Nonradiological

Air Quality

Air quality is protected by enforcing emission limits and maintenance requirements for pollution control equipment, as required by several operating permits issued by the Tennessee Air Pollution Control Board, Department of Environment and Conservation. Operations from the BLEU Project are not expected to have a significant impact on off-site nonradiological air quality. Effluent air emissions from the BPF will be discharged through the existing main NFS stack. The current emissions estimates (Table 2.4) include [redacted] Complex releases (now discontinued) that are expected to bound the BPF air quality impacts (Ref. 2). As a result, a separate column for BFP effluent estimates is not included in Table 2.4. The estimated BLEU Complex emissions (Table 2.4) are below estimated emissions of all currently permitted sources of criteria and hazardous air pollutants at the NFS Erwin Plant. When estimated BLEU Complex emissions are added to the current facility estimates, current allowable limits are met except for nitrogen oxides which exceed limits by a small amount (Table 2.4). However, current concentration estimates at the nearest site boundary are two to three orders of magnitude less than the most stringent State of Tennessee primary air-quality standards (Ref. 3). The addition of the estimated BLEU Project gaseous effluent emissions to current NFS Erwin Plant emissions should not result in levels that exceed the primary air-quality standards. NRC expects the Tennessee Air Pollution Control Board will set limits for pending air permits in a manner that will continue to protect local air quality and avoid potentially adverse environmental impacts.

Surface Water

Surface water runoff from the proposed action will generally flow to the northwest across the proposed BLEU Complex. This runoff will drain to culverts at the northwest boundary of the NFS site, and then empty into Martin Creek. A storm water construction permit will be obtained from the Tennessee Department of Environment and Conservation prior to any construction activities that would disturb the land. Erosion and sediment control measures (e.g., straw bales and silt fences) will be employed to mitigate surface runoff into the drainage ditches and Martin Creek, thus reducing the impacts to surface water during the construction of the proposed BLEU Complex. Sluice gates will be installed at collection points within the proposed BLEU Complex for containment of any hazardous spills during the lifetime of BLEU operations (Ref. 2).

As discussed in Section 3.9.2, several chemical contaminants from historical plant operations have been detected in Banner Spring Branch at levels which exceed health-based criteria. In the North Site Decommissioning Plan, NFS has proposed the removal of contaminated soils, sediments, and piping, which are believed to be the source of the contamination (Ref. 4). As a result of these activities it is anticipated that contamination of surface water from these sources is unlikely to increase in the future. In addition, NFS routinely will monitor Banner Spring Branch for cyanide and zinc, as recommended in the Resource Conservation and Recovery Act Facility Investigation Report for Areas of Concerns 2 (Building 111 boiler blowdown and backwash water) and 4 (storm sewer system). No contamination of other surface waters due to current plant activities has been identified (Ref. 4).

Surface water quality is expected to be protected from future site activities by enforcing release limits and monitoring programs, as required under the NPDES permit. No impact on NPDES permit limits is anticipated with respect to operations at the proposed BLEU Complex or downblending at the BPF (Ref. 5). NFS is required to meet NPDES limits, and Emergency Action Plans and Flood Warnings Systems will protect adequately the public water supply from potential contamination (Ref. 6). Discharges from the proposed action are not expected to have significant impact on the surface water quality in the Nolichucky River because of the dilution volume in the river.

Groundwater

Previous operation of the plant has resulted in localized chemical and radiological contamination of groundwater, including beneath the BPF, as described in Section 3.9.3. Groundwater monitoring conducted by NFS indicates that plumes of uranium, tetrachloroethylene, TCE, 1,2-dichloroethylene, and vinyl chloride could migrate offsite in the direction of the Nolichucky River (Ref. 7). To address potential environmental impacts from this contamination, NFS has removed much of the source contamination through extensive remediation projects including excavation of contaminated areas in the North Site. In addition, NFS is decommissioning the Radiological Burial Ground and the North Site to remove more of the source of this contamination. NFS also is working with the Tennessee Department of Environment and Conservation and the EPA to design remedial strategies and to investigate the off-site extent of existing plumes.

For normal operations, the proposed action will not discharge any effluents to the groundwater; therefore, no adverse impacts to groundwater are expected. Accidental releases of contaminants to groundwater appear unlikely due to design and control measures implemented by NFS (Section 5.1.2.2); however, detailed analysis of credible accident scenarios and consequences will be provided by NFS and reviewed by NRC in a forthcoming license amendment request pertaining to the proposed action. This later review will ensure that potential environmental impacts from accidents will have been addressed adequately [through compliance with 10 CFR Part 70 (Ref. 1) performance requirements] prior to approval of the license amendments pertaining to the BLEU Project.

Groundwater modeling conducted by NFS indicates that contaminants originating from the NFS site should not have an impact on local drinking water because plumes are not expected to intersect the capture zones for local wells in the vicinity of the plant. To maintain confidence that safety will be maintained, NRC will continue to require routine groundwater monitoring by NFS to assess the nature and extent of groundwater contamination. NFS will also be required to conduct remediation, if necessary, to prevent offsite impacts to human health and safety.

Land Use

The portion of the proposed action that relies on existing facilities will not have any additional adverse impacts to local area land use. Proposed construction is planned to occur on NFS owned property that previously has been disturbed. There also appear to be no other competing land use alternatives for the proposed construction site. Therefore, no adverse impacts to local land use are expected.

Biotic Resources

The most directly impacted area is the proposed construction site for the BLEU Complex. Because this area is a grass field that previously has been disturbed, no adverse environmental impacts to biota are expected. Potential impacts to local stream ecology from construction runoff and siltation will be mitigated by implementation of erosion control measures consistent with an existing NFS erosion control plan.

Cultural Resources

The proposed action requires modification to existing buildings on the NFS site, relocation of the downblending operation to an existing building in the NFS protected area, and construction of new facilities on the NFS facility. The impacts to cultural resources should not be different from those evaluated for the site in the license renewal EA (Ref. 3). The proposed site 2.0 hectares (5 acres) was most recently used by NFS staff as a recreational softball field, and previously has been disturbed by earthmoving activities. No historical structures or Native American sacred sites are known to exist on the proposed site. It is unlikely that the proposed action would result in additional disturbance to cultural resources. Regional historical properties and historical landmarks would not be disturbed by the proposed activities because of their distance from the site.

Socioeconomics

As noted in Section 3.3, there are no minority or low-income populations in the vicinity of the NFS facility that would bear a disproportionate impact from the proposed activities. The area around the facility has a much smaller minority population than the State of Tennessee as a whole. The median household incomes for all counties in the ROI are greater than the poverty threshold. The primary socioeconomic impact of the proposed action would be the effects on the local labor force for construction of the proposed facility and operation of the BLEU Complex. In 2001, the entire NFS facility employed a labor force of more than 650, an increase of about 300 since 1996 (Ref. 3). Employment is expected to decline after 2003 due to the completion of planned decommissioning activities (Ref. 2). Planned activities associated with the construction and operation of the BLEU Project would offset the planned job reductions to some extent. The offset in the total labor force between completion of decommissioning and employment associated with the proposed action should limit the impact on the local infrastructure and community services (Ref. 2). The available housing in Unicoi County is sufficient to absorb any likely increase in work population.

Transportation

The proposed action involves transportation of (i) feed material (both uranium oxide and HEU) to NFS for processing, (ii) UN solution from NFS to the Savanna River Site in North Carolina, (iii) enriched UN solution from SRS to NFS, and (iv) the NFS product (uranium oxide powder) to the Framatome ANP Inc. site in Richland, Washington. All transportation would be conducted using NRC approved casks in accordance with the applicable NRC and U.S. Department of Transportation regulations. Both radiological and nonradiological risks to workers and the public from these transportation scenarios (or similar scenarios that bound the consequence estimates) have been assessed by DOE in the FEIS for disposition of surplus HEU (Ref. 6) and are summarized in the TVA record of decision (ROD) (66 FR 57997). No significant adverse environmental impacts were identified regarding the proposed transportation activities (Ref. 6).

The method of transfer of LEU solution from the BPF to the BLEU Complex has not been chosen by NFS at the time of this writing; however, it may involve use of tanker trucks. NRC expects the method of transfer will be described in a forthcoming license amendment request and potential impacts associated with the method of transfer will be addressed in the associated integrated safety assessment. NRC review of this report to assess compliance with 10 CFR Part 70 requirements (Ref. 1) is sufficient to provide confidence that any potentially adverse impacts will be considered prior to a decision on the BLEU Project license amendments. If the environmental impacts due to the method of transportation are not bounded by this EA, another one will be prepared during the safety review for this action.

5.1.1.2 Radiological Impacts from Proposed Operations

Radiological impacts from the proposed BLEU Project operations include release of small quantities of radioactive material to the atmosphere and surface water. Radionuclides that may be released include isotopes and some daughter products of the actinide elements uranium, thorium, plutonium, americium, actinium, and lesser quantities of fission products including technetium, cesium, and strontium. Based on source material properties and processing information, NFS has estimated the quantities of airborne and liquid effluents and used this information to estimate doses to the maximally exposed individual. The documentation of these calculations are provided in the additional information letter (Ref. 5) and RAI response (Ref. 8). Effluent and dose calculation results by release point are provided in Tables 5.1 and 5.2. While some effluents for the proposed action are increasing in relation to current releases, the total annual dose estimate for the maximally exposed individual from all planned effluents is 0.022 mSv (2.2 mrem). This result is well below the annual public dose limit of 1 mSv (100 mrem) in 10 CFR Part 20 and the 0.1 mSv (10 mrem) ALARA constraint. The estimated dose is conservative because no pollution control was assumed for a number of radionuclides (Ref. 5, Attachment 23, Table 2). For the proposed action effluents, BPF liquid effluents are discharged to the WWTF, and BLEU Complex liquid effluents are discharged to the sanitary sewer. Sanitary sewer releases are not included in the dose calculations because the dose receptor used for the calculations (maximally exposed individual) would not be exposed to the sewer effluent exposure pathways.

The documentation of effluent estimates includes detailed radionuclide data for feed material, mass balance and process flow diagrams, bases for release fractions for various processing steps, pollution control removal efficiencies, and tabulation of results. For dose assessment, the effluent estimates were multiplied by unit dose coefficients calculated using pathway dose assessment software for each type of release scenario (i.e., airborne, liquid).

Table 5.1 Comparison of current liquid effluent releases with estimated effluents and dose from the proposed action

Element	Removal Factor[a]	Proposed Action WWTF Effluent (Ci/yr)[b]	Current WWTF Effluent (Ci/yr)	As Percentage of Current WWTF Effluent (%)	Proposed Action Effluent Dose (mrem/yr)[c]
Uranium	0.0024	1.05E-4	6.3E-4	16.6	2.93E-3
Thorium	0.0024	9.10E-3	4.4E-6	2.1E+5	1.01E+0
Plutonium	1.0000	3.09E-2	5.3E-7	5.8E+6	4.36E-1
Americium	1.0000	5.56E-4	—[d]	—[d]	2.72E-2
Neptunium	1.0000	7.67E-3	—[d]	—[d]	4.45E-1
Actinium	1.0000	1.39E-4	—[d]	—[d]	1.16E-1
Cesium	1.0000	6.75E-4	—[d]	—[d]	1.82E-2
Technetium	1.0000	1.75E-4	1.6E-2	1.1	2.98E-4
Strontium	1.0000	3.45E-04	—[d]	—[d]	3.45E-3
Total					2.06E+0

[a] The removal factor represents the assumed fraction of material remaining in effluent following treatment at the WWTF. A factor of one assumes no treatment and this is conservative since treatment is planned.

[b] To convert Ci to Bq, multiply by 3.7E+10.

[c] To convert mrem to mSv, multiply by 0.01.

[d] Not estimated for current releases.

Source: B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "Additional Information to Support an Environmental Review for BLEU Project," January 15, 2002. (Ref. 5), Attachment 23.

Table 5.2 Comparison of current airborne effluents with estimated effluents from the proposed action (including the combined dose estimate)

Element	Current Main Stack Average (Ci/yr)[a]	Current Remaining Stack Average (Ci/yr)[a]	Proposed BLEU Prep Facility (Ci/yr)[a]	Proposed BLEU Complex (Ci/yr)[a]	Proposed WWTF (Ci/yr)[a]	Totals
Uranium	2.84E-4	3.1E-5	1.1E-3	2.3E-5	4.7E-5	1.5E-3
Thorium	5.7E-7	7.2E-6	1.7E-5	3.4E-7	2.0E-5	4.5E-5
Plutonium	0.0E+0	4.7E-5	1.4E-7	2.8E-9	1.6E-7	4.7E-5
Americium	0.0E+0	9.4E-7	2.5E-9	5.0E-11	2.9E-9	9.4E-7
Dose (mrem/yr)[b]	2.60E-2	1.50E-2	7.37E-2	8.00E-3	7.90E-2	2.02E-1

[a] To convert Ci to Bq, multiply by 3.7E+10.

[b] To convert mrem to mSv, multiply by 0.01.

Source: B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "Additional Information to Support an Environmental Review for BLEU Project," January 15, 2002. (Ref. 5), Attachment 22.

Airborne release unit dose factors were calculated using the CAP–88 PC V2.0 code (Ref. 9). The CAP–88 PC V2.0 code was developed by EPA to demonstrate compliance with National Emissions Standards for Hazardous Air Pollutants. A modified Gaussian plume equation in CAP–88 PC V2.0 estimates the average dispersion of radionuclides released from various sources. Calculations were done using a circular grid to distances up to 80 km (50 mi). Effective dose equivalent calculations (i.e., organs and weighting factors) are consistent with the methods in International Commission on Radiological Protection ICRP 26 (Ref. 10) and 30 (Ref. 11). NFS used the EPA rural food source agricultural data for an agricultural exposure scenario that includes consumption of meat, milk, and crops raised in the plume transport/deposition path (Ref. 8). Meteorological data from the NFS license renewal ER (Ref. 12) were used for plume transport calculations (Ref. 8).

Documentation for the liquid release unit dose factors is provided in Ref. 13. Details of the methods used to calculate these dose factors were clarified in a discussion with NFS technical staff (Ref. 14). Calculations were based on the national Council on Radiation Protection 123 screening methodology (Parts 1 and 2) (Ref. 15). The receptor was located at the nearest point of water use {the Jonesborough Water Plant located 13 km (8 mi) downstream from the WWTF outfall (Ref. 14)}. A few irrigation uses exist closer to the plant; however, NFS has found the doses calculated for the Jonesborough location bound the dose estimates for the irrigation locations.

The dose to the workers at the NFS site has been analyzed in the Renewal EA (Ref. 3). The potential for increase in dose to workers at NFS due to the BLEU project was evaluated. Operation of the BPF, OCB and UNB is not expected to increase the dose to workers at the NFS facility because the types and quantity of material, and the processing, will be similar to what is already licensed at the site. NFS is committed to keeping doses as low as reasonable achievable (ALARA) by maintaining a radiation protection program that minimizes radiation exposures and releases of radioactive material to the environment. In order to accomplish this, NFS has procedures for working with radioactive materials and monitoring programs to determine the doses received by employees.

5.1.2 Evaluation of Potential Accidents

The conversion of HEU materials to low-enriched uranium dioxide at the BLEU Project will require the handling, processing, and storage of radioactive material and hazardous chemicals. An uncontrolled release of these materials from accidents could pose a risk to the environment as well as to workers and public health and safety. The methods and analysis employed to characterize the potential hazards posed by these materials and processes are described in this section.

The evaluation of potential accidents is carried out at a general level of detail in this report to establish that the proposed processes, as described by NFS, will function safely with no significant adverse impacts to safety or the environment. A more detailed evaluation of the proposed processes will be carried out by the NFS in its integrated safety analysis that will be submitted in the forthcoming BLEU Project license amendment requests. NRC review of the NFS integrated safety analysis will ensure compliance with NRC accident safety requirements in 10 CFR 70.61 (Ref. 1). Successful compliance with the safety requirements in 10 CFR Part 70 (Ref. 1) will provide additional confidence that potential accidents have been adequately evaluated prior to making a decision on the proposed license amendments.

5.1.2.1 Accident Analysis Methods

For this EA, an evaluation of available information was performed to determine potential hazards for the four main buildings associated with the BLEU Project and for the related chemical and waste storage tanks. In each instance, the evaluation examines the inventory of materials to be used, the processing parameters, and the reactions occurring in the process, to evaluate potential hazards in each facility.

5.1.2.2 Evaluation of Accidents in the Processing Facilities of the BLEU Project

The dissolution and downblending of HEU feed materials to low-enriched UN solution will be carried out in the BLEU Preparation Facility (Figure 2.1). The primary chemicals used in the dissolution and downblending processes in the BPF are: Nitric acid (70 percent solution); hydrogen peroxide (30 percent solution); sodium hydroxide (30 percent solution); sodium nitrate (45 percent solution); barium oxide (BaO); tributyl phosphate [$(C_4H_9)_3PO_4$]; normal paraffin fluid (Nopar 12 fluid); sodium carbonate (Na_2CO_3) (Ref. 8). The radioactive feed materials used include HEU/aluminum alloy, HEU metal (buttons), and natural uranium oxide. Reaction products and intermediates include sodium diuranate, and UN solutions.

Information on tank sizes, controls, locations, berm size for spill containment, and other attributes is listed in the tables in Attachments II and III of Ref. 8. The process operations are described in References 2 and 8, and are summarized in Section 2.1.1 of this report. Many of the proposed process operations are patterned after existing, NRC licensed processes, so operational experience and history build confidence that operations can be executed safely.

Proposed process operations, such as the downblending of high-enriched UN to low-enriched UN, liquid-liquid extraction to purify UN solution, and HEU storage, are very similar to *corresponding processes presently licensed under NRC License SNM–124 (Ref 1). Other* process operations are new. Potential hazards associated with new operations were evaluated during the NRC review.

Primary hazards associated with the operation of the BLEU Preparation facility involve: spill of chemical and or radioactive material in the building, leak in a storage tank or supply piping, release of gaseous and particulate effluents (chemical and/or radioactive materials) due to a malfunction of the process off gas treatment system, and upset in the control of process parameters leading to undesirable reactions and release of hazardous or explosive compounds such as hydrogen, hydrogen peroxide, ammonia, NO_x, nitric acid vapors. The loss of control of the process may include release of radioactive materials and nuclear criticality. The potential accidents for the BPF are summarized in Table 1 of Ref. 2. These accidents can potentially impact worker safety, public health and safety, and the environment.

Primary controls relied upon to guard against inadvertent nuclear criticality in processing operations include concentration limits and use of favorable geometry process vessels. Measures to ensure chemical safety and safe handling of radioactive materials include the following:

- Process off gases will be treated through scrubbers and HEPA filters prior to stack discharge (Ref. 2).

- Process parameters will be controlled, and concentrations of hazardous or explosive chemicals will be maintained at safe levels. For example, sodium nitrate will be used in the HEU aluminum alloy dissolution process to minimize the formation of hydrogen, and air will be used in the dissolver to dilute the small quantities of hydrogen formed to safe levels (Ref. 8).

Based on the information furnished in the NFS reports and summarized above (Refs. 2, 5, 8), the safety controls to be employed in the processes for the BPF appear to be sufficient to ensure planned processing will be safe.

As noted previously, NRC review of the forthcoming NFS integrated safety analysis will ensure compliance with NRC accident safety requirements in 10 CFR 70.61 (Ref. 1). Successful compliance with the safety requirements in 10 CFR Part 70 (Ref. 1) will provide additional confidence that potential accidents have been adequately evaluated prior to making a decision on the proposed license amendments. The integrated safety analysis will also include a Fire Hazard Analysis for the processes located in the BPF. The Fire Hazard Analysis will identify high and intermediate consequence accident scenarios and define management measures in compliance with the requirements of 10 CFR 70.61 (Ref. 1) and the applicable portions of the National Fire Protection Association codes, as specified in Chapter 6 of the NFS license renewal application (Ref. 16).

5.1.2.3 <u>Evaluation of Potential Accidents Regarding Tank Storage of Processing Solutions</u>

Operations at the BPF (Figure 2.1) and BLEU Complex (Figure 2.2) will include the storage of processing materials in tanks. The BPF will include nine storage tanks to be used for various combustible liquids, sodium carbonate, process waste, and uranyl nitrate solutions (Ref. 8). The BLEU Complex will utilize tanks for storage of low-enriched UN solution in the UNB (24 tanks). Twelve additional tanks will be used for storing process chemicals and wastes (Ref. 8). The main chemicals to be used and stored in the BLEU Complex are: low-enriched UN solution, natural UN, anhydrous ammonia, aqueous ammonia (23 percent solution), nitric acid (50 percent solution), nitric acid (7 percent solution), liquid nitrogen, sodium hydroxide (50 percent solution), liquified petroleum gas (propane), and diesel fuel (Ref. 8).

Primary hazards associated with the operation of the BLEU Project storage tanks involve: spill of chemical and or radioactive material in a building, leak in a storage tank or supply piping, and upset in the control of process parameters leading to undesirable reactions, release of gaseous and particulate effluents (chemical and/or radioactive materials) due to fire, and release of hazardous or explosive compounds such as hydrogen, hydrogen peroxide, ammonia, NO_x, nitric acid vapors. The loss of control of processing linked to storage tanks may include release of radioactive materials and nuclear criticality. The potential accidents for the facilities of the BLEU Project are summarized in Tables 1 and 2 of Ref. 2. These accidents can potentially impact worker safety, public health and safety, and the environment.

Primary controls relied upon to guard against inadvertent nuclear criticality in storage operations include concentration limits and use of favorable geometry. Measures to ensure chemical safety and safe handling of radioactive materials include the following:

- Tanks will be bermed for spill control and isolation (Ref. 8, Attachments II and III).
- Tanks will be equipped with level control for overfill protection (Ref. 8, Attachments II and III).

Based on the information furnished in the NFS reports and summarized above (Refs. 2, 5, 8), the safety controls to be employed in the processes for tank storage of process chemicals appear to be sufficient to ensure planned storage will be safe.

As noted previously, NRC review of the forthcoming NFS integrated safety analysis will ensure compliance with NRC accident safety requirements in 10 CFR 70.61 (Ref. 1). Successful compliance with the safety requirements in 10 CFR Part 70 (Ref. 1) will provide additional confidence that potential accidents have been adequately evaluated prior to making a decision on the proposed license amendments. The integrated safety analysis will also include a Fire Hazard Analysis for the BPF and the BLEU Complex where process materials will be stored. The Fire Hazard Analysis will identify high and intermediate consequence accident scenarios and define management measures in compliance with the requirements of 10 CFR 70.61 (Ref. 1) and the applicable portions of the National Fire Protection Association codes, as specified in Chapter 6 of the NFS license renewal application (Ref. 16).

5.1.2.4 <u>Evaluation of Potential Accidents at the BLEU Complex</u>

Operations planned to be performed in the BLEU Complex area (Figure 2.2) include processing the LEU solution into uranium dioxide powder in the OCB, and treatment of the liquid effluent stream from the OCB in the EPB. NFS plans to covert the LEU solution to uranium dioxide powder in the OCB using the Framatome ANP Inc. process which has been previously approved under NRC License SNM-1227 (Ref. 8). The main chemicals to be used and stored in the BLEU Complex are: low-enriched UN solution, anhydrous ammonia, aqueous ammonia (23 percent solution), nitric acid (50 percent solution), nitric acid (7 percent solution), liquid nitrogen, sodium hydroxide (50 percent solution), liquified petroleum gas (propane), and diesel fuel (Ref. 5).

Primary hazards associated with the operation of the BLEU Complex facilities involve: spill of chemical and or radioactive material in a building, leak in a storage tank or supply piping, release of gaseous and particulate effluents (chemical and/or radioactive materials) due to a malfunction of the process off gas treatment system, and upset in the control of process parameters leading to undesirable reactions and release of hazardous or explosive compounds such as hydrogen, hydrogen peroxide, ammonia, NO_x, nitric acid vapors. The loss of control of the process may include release of radioactive materials and nuclear criticality. The potential accidents for the facilities of the BLEU Complex are summarized in Table 2 of Ref. 2. These accidents can potentially impact worker safety, public health and safety, and the environment.

Primary controls relied upon to guard against inadvertent nuclear criticality in processing operations include concentration limits and use of favorable geometry process vessels. Staff have additional confidence that oxide conversion can be operated safely at the BLEU Complex because the planned Framatome ANP Inc. process has been previously approved by NRC under License SNM-1227. Planned processing at the BLEU Complex that is not covered by the Framatome ANP Inc. process include the storage of uranyl nitrate in the 24 tanks discussed in the previous section, and the concentration and solidification of liquid wastes at the EBP. The concentration and solidification process is a common industrial process and hazards are expected to be limited by the processing to remove uranium and ammonia from the process stream (Figure 2.3). Proposed controls to monitor the effluent processing temperature, pressure, pH and provide adequate ventilation to mitigate dust exposure hazards (Ref. 8) provide additional confidence that operations can be conducted safely.

Based on the information furnished in the NFS reports and summarized above (Refs. 2, 5, 8), the safety controls to be employed in the processes for the BLEU Complex appear to be sufficient to ensure planned processing will be safe.

As noted previously, NRC review of the forthcoming NFS integrated safety analysis will ensure compliance with NRC accident safety requirements in 10 CFR 70.61 (Ref. 1). Successful compliance with the safety requirements in 10 CFR Part 70 (Ref. 1) will provide additional confidence that potential accidents have been adequately evaluated prior to making a decision on the proposed license amendments. The integrated safety analysis will also include a Fire Hazard Analysis for the processes located in the BLEU Complex. The Fire Hazard Analysis will identify high and intermediate consequence accident scenarios and define management measures in compliance with the requirements of 10 CFR 70.61 (Ref. 1) and the applicable portions of the National Fire Protection Association codes, as specified in Chapter 6 of the NFS license renewal application (Ref. 16).

5.1.3 Cumulative Impacts

Cumulative impacts from the proposed BLEU Project activities were assessed by considering impacts associated with the proposed action that would add to known impacts associated with the existing facility.

A primary focus for evaluating cumulative impacts was the magnitude of proposed chemical and radiological air and water effluents in relation to existing effluents for similar contaminants. Increases to some chemical effluents are possible (Table 2.4); however, compliance with existing and new effluent permits is expected to limit potential impacts to satisfactory levels. Increases in airborne chemical effluents will require changes to existing permits; however, NRC expects the State-permitting authorities will set limits for NFS that will serve to control total effluents to the air in the region to acceptable limits. Radiological effluents associated with the proposed action and for the NFS facility are included in the dose estimates provided in Tables 5.1 and 5.2. These dose estimates show the incremental dose expected from the proposed action is negligible {0.02 mSv/yr (2 mrem/yr)} considered alone and when added to the total facility dose. Both doses are well within the 1 mSv/yr (100 mrem/yr) public dose limit as well as the .1 mSv/yr (10 mrem/yr) ALARA constraint as defined in 10 CFR Part 20. The total dose for the entire duration of the BLEU project is expected to be approximately 0.1 mSv (10 mrem).

A summary of potential impacts is provided in Table 5.3. When considered together and in relation to existing plant impacts, and in light of existing regulatory controls, these impacts still represent a small change to existing conditions in the area surrounding the plant.

Table 5.3 Comparison of environmental impacts

Impact Category	Current Operations	Downblending (BLEU Prep Facility)	BLEU Complex	DOE EIS-0240
Air Quality	Air pollutant concentrations are less than applicable standards	Air pollutant concentrations will be less than applicable standards	Air pollutant concentrations will be less than applicable standards	Air pollutant concentrations will be less than standards (page 4-130)
Surface Water	Concentrations are below NPDES limits	No impact on NPDES limits	No impact on NPDES limits	Required to meet NPDES limits.
Groundwater	Localized existing contamination, monitoring program in place	Localized existing contamination, monitoring program in place	Groundwater not impacted by operations	No direct discharge to groundwater. No groundwater used. Not impacted by operation
Land Use	73% of 69.9 Acres developed	No impact (existing building used)	Developed area increases to 80% of 69.9 acres	N/A
Biotic Resources	All activities in previously disturbed area	All activities in previously disturbed area	5-acre vacant previously disturbed field used. No critical habitat.	No significant adverse impact (page 4-30)

Table 5.3 Comparison of environmental impacts (continued)

Impact Category	Current Operations	Downblending (BLEU Prep Facility)	BLEU Complex	DOE EIS–0240
Socioeconomic	652 employees	No additional employment for operations. 130 temporary construction jobs.	No additional employment for operations. 130 temporary construction jobs.	126 employees for operations and 295 indirect jobs estimated. No inward migration.
Cultural Resources	No known impact	No known impact	No known impact	None identified but possible (low probability)
Radiological				
Maximally Exposed Individual, Air Releases	0.041 mrem/yr[a]	0.153 mrem/yr[a]	0.008 mrem/yr[a]	0.14/0.17 mrem/yr[a]
Maximally Exposed Individual, Liquid Releases	Not Estimated	2.06 mrem/yr[a]	N/A for sewer effluents	0 / 9E–4 mrem/yr[a]
Population Dose, Air Releases	N/A	N/A	N/A	1.2/1.5 person-rem/yr[b]
Population Dose, Liquid Releases	N/A	N/A	N/A	0 to 1.9E–3 person-rem/yr[b]
Population Dose, Transportation	2.32E–2 person-rem[b]	Transportation evaluated in DOE EIS and TVA ROD[d]	Transportation evaluated in DOE EIS and TVA ROD[d]	Low Impacts
Accidents	Criticality: Nearest Property Boundary/Nearest Resident	Criticality: Nearest Property Boundary/Nearest Resident	Criticality: Nearest Property Boundary/Nearest Resident	Earthquake Criticality Scenario
Radiological	Not Estimated/ 9.4 rem[b]	33 rem/9.4 rem[b]	61 rem/9.2 rem[b]	67 rem[b] (non-involved worker)
Transportation, Vehicular	0.717 fatality[c]	Transportation evaluated in DOE EIS and TVA ROD[d]	Transportation evaluated in DOE EIS and TVA ROD[d]	Low Impacts

N/A = Not applicable.

[a] To convert mrem to mSv, multiply by 0.01.
[b] To convert rem to Sv, multiply by 0.01.
[c] Sum of reported values in license renewal EA (Ref. 3).
[d] Tennessee Valley Authority (TVA) Record of Decision (ROD). Federal Register, Volume 66, No. 223, November 19, 2001.

5.1.3.1 Cumulative Radiological Impacts due to the Proximity of the Studsvick Facility

The Studsvick Facility is located adjacent to the NFS property, just south of the proposed BLEU complex. This facility is licensed by the state to process radioactive wastes. Due to the proximity of the two facilities, the staff evaluated cumulative radiological impacts from air effluents, liquid effluents, and direct radiation. The annual average of NFS effluent data from 1996 through 2000 and the most recent effluent data (CY2000) from the operations at Studsvick adequately characterizes the impacts from current operations. Foreseeable future impacts of the BLEU Project (including BLEU Preparation facility, additional Waste Water Treatment Facility effluents and BLEU Complex effluents) were also considered.

Air Effluents

The results are summarized in Table 5.4 in terms of total effective dose equivalent to the maximally exposed member of the public. Future impacts from air emissions from NFS operations are estimated using environmental monitoring data from 1996 through 2000 (Ref. 8). The air emissions estimate for Studsvick, Inc., is based on year 2000 data (Ref. 17). To bound the impacts, the baseline dose from NFS operations and current estimates of doses attributable to Studsvick are added to the foreseeable future impacts of BLEU Project operations. Though it is not likely that the same individual is the maximally-exposed individual for each of the facilities, the sum of these doses are considered to bound future impacts.

Liquid Effluent

As demonstrated in semi-annual effluent reports, current liquid releases from the NFS site are well within the regulatory limits listed in 10 CFR Part 20. NFS has provided conservatively-derived estimates of future discharges from the BLEU Project which were estimated using NCRP 123 (Ref. 8). The dose from these effluents, which are dominated by contributions from the solvent extraction raffinate at the BLEU preparation facility, when added to existing effluents, remain within regulatory limits.

Sewer Discharges

The staff evaluated cumulative impacts to the sewer system of combined NFS, BLEU Project and Studsvick by estimating bounding concentrations that would be present in individual streams. NFS estimated the discharge from the BLEU Complex to be 6,300 gallons per day (Ref. 8). This daily discharge volume was used to convert estimated quantities of annual discharges from the BLEU Complex (in units of curies) in terms of liquid concentration. Concentration values for Studsvick were also obtained from a year 2000 inspection report. The data are summarized in Table 5.5.

In Table 5.5, the bounding contributions from either NFS baseline operations or future BLEU operations are used to compare against the 10 CFR 20, Appendix B sewer discharge limits. These impacts, along with the discharge fractions from Studsvick operations, are summed for comparison using the unity rule. The value of 0.059 is considerably less than 1, which indicates that sewer discharges will remain a low cumulative impact.

Direct Radiation

Direct radiation monitoring data are available for both Studsvick, Inc. and NFS operations (Ref. 8 and 17). Both licensees and the State of Tennessee Department of Environment and Conservation monitor direct radiation. Because the direct radiation monitored at the fenceline is a cumulative value (dose from both sites), the monitoring program ensures that this dose will not exceed regulatory limits. Both facilities have successfully demonstrated compliance in the past. Due to the nature of the materials in the BLEU complex, direct radiation is not expected to increase as a result of this project.

Table 5.4. Estimate of the Total Effective Dose Equivalent (mrem) to the Maximally Exposed Member of the Public Offsite by Pathway.

Source of Emissions	Radionuclide and Radiation Pathways (mrem)		
	Air Emissions	Liquid Effluent	TEDE
NFS (Baseline)	0.041 [1]	N/A	0.041
BLEU Project:			
BLEU Preparation Facility	0.074 [1]	--- [3]	0.074
WWTF	0.153 [1]	2.45	2.6
BLEU Complex	0.0081 [1]	--- [4]	0.0081
Studsvick, Inc.	0.0542 [2]	--- [5]	0.0542
TOTAL	0.33	2.45	2.78 [6]

[1] Nuclear Fuel Services, NFS Responses to NRC's Request for Additional Information to Support an Environmental Review for the BLEU Project, Table 3-2, March 15, 2002.

[2] Letter from Mark Andrews, Tennessee DEC, Division of Radiological Health to Maurice Carson, Manager of Studsvick Processing Facility, LLC, RE: Inspection Report for License No. R-86011-K06, p. 15, November 16, 2001. This data is for calendar year 2000.

[3] The BPF's liquid effluents will only be discharged through the WWTF.

[4] BLEU Complex's effluents will only be discharged to the sanitary sewer.

[5] No TEDE data for discharges of ^{60}Co, ^{137}Cs and ^{3}H to the sanitary sewer are available from Studsvick, Inc. See Table 5.5 for comparison of sanitary sewer discharge data for Studsvick and NFS.

[6] The cumulative impact of current and foreseeable future operations on the NFS property is less than 2.78 mrem TEDE per year to the maximally exposed member of the public offsite. This represents a latent cancer fatality risk per year of exposure of 1.4×10^{-6}.

N/A = data not available because dose analysis are not required if the concentrations are below those listed in Appendix B to 10 CFR 20.

Table 5.5 Cumulative Impacts to Sanitary Sewer of Discharges from NFS, BLEU Complex and Studsvick, Inc.

Radionuclide	NFS Baseline[1] [μCi/mL]	BLEU Complex[2] [μCi/mL]	NFS Total [μCi/mL][3]	Studsvick [μCi/mL]	10 CFR 20, App.B Limit [μCi/mL]	Fraction of Limit
^{3}H				$3.85x10^{-7}$	$1x10^{-2}$	$3.9x10^{-5}$
^{60}Co				$5.53x10^{-7}$	$3x10^{-5}$	$1.8x10^{-2}$
^{99}Tc	$2.61x10^{-8}$	$1.28x10^{-7}$	$4.30x10^{-8}$		$6x10^{-4}$	$7.2x10^{-5}$
^{137}Cs				$3.35x10^{-7}$	$1x10^{-5}$	$3.4x10^{-2}$
^{228}Th	$9.93x10^{-11}$	$3.70x10^{-13}$	$8.29x10^{-11}$		$2x10^{-6}$	$4.1x10^{-5}$
^{230}Th	$9.04x10^{-11}$	$8.70x10^{-15}$	$7.54x10^{-11}$		$1x10^{-6}$	$7.5x10^{-5}$
^{232}Th	$2.18x10^{-12}$	$3.64x10^{-17}$	$1.82x10^{-12}$		$3x10^{-7}$	$6.1x10^{-6}$
^{234}U	$1.68x10^{-8}$	$1.73x10^{-8}$	$1.68x10^{-8}$		$3x10^{-6}$	$5.6x10^{-3}$
$^{235/36}U$	$5.92x10^{-10}$	$4.01x10^{-9}$	$1.16x10^{-9}$		$3x10^{-6}$	$3.9x10^{-4}$
^{238}U	$1.91x10^{-9}$	$8.29x10^{-10}$	$1.73x10^{-9}$		$3x10^{-6}$	$5.8x10^{-4}$
^{238}Pu	$4.36x10^{-11}$	$2.76x10^{-14}$	$3.64x10^{-11}$		$2x10^{-7}$	$1.8x10^{-4}$
$^{239/40}Pu$	$3.47x10^{-11}$	$1.78x10^{-15}$	$2.90x10^{-11}$		$2x10^{-7}$	$1.5x10^{-4}$
					TOTAL	0.059

[1] NFS Baseline based on CY 2000 discharges as presented in semi-annual environmental data report.

[2] BLEU Complex concentrations based on annual discharges in curies (NFS, March 15, 2002) divided by 6,300 gpd discharge rate.

[3] NFS Baseline and BLEU Complex total is flow-averaged based on an annual flow rate of $4.37x10^{7}$ liters in CY 2000 for NFS and an estimated $8.7x10^{6}$ liters for BLEU Complex.

5.2 Impacts of No Action Alternative

Under the no action alternative, NFS would not be able to carry out its contract obligations to produce a commercial product from U.S. Government surplus weapons-usable HEU. Failure to fulfill its role in the DOE program could cause DOE to select other alternatives for disposition of the surplus material that may be less cost effective and incur greater environmental impacts. For example, the disposal option would incur additional costs and consume available disposal space that may be better utilized for non-reusable wastes. If NFS were not able to fulfill its contract, DOE may also transfer the downblending work to other facilities with no net positive benefit to the environment.

5.3 References for Section 5

1. U.S. Code of Federal Regulations, "Domestic Licensing of Special Nuclear Material," Part 70, Chapter 1, Title 10, *Energy*.

2. B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "Supplemental Environmental Report for Licensing Actions to support the BLEU Project," November 9, 2001.

3. T. Cox, U.S. Nuclear Regulatory Commission, Letter to T.S. Baer, Nuclear Fuel Services, Inc., "Finding of No Significant Impact and Environmental Assessment (TAC NO. L30873)," January 29, 1999.

4. Nuclear Fuel Services, Inc., "North Site Decommissioning Plan," Erwin, Tennessee, November 1997.

5. B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "Additional Information to Support an Environmental Review for BLEU Project," January 15, 2002.

6. U.S. Department of Energy, "Disposition of Surplus High Enriched Uranium Final Environmental Impact Statement," Volume 1, June 1996 (DOE/EIS–0240).

7. Geraghty and Miller, Inc., "Final Project Report–Groundwater Flow and Constituent Transport Modeling at the Nuclear Fuel Services, Inc. Facility, Erwin, Tennessee," April 25, 1996.

8. B.M. Moore, Nuclear Fuel Services, Inc., Letter to U.S. Nuclear Regulatory Commission, "NFS Responses to NRC's Request for Additional Information to Support an Environmental Review for the BLEU Project," March 15, 2002.

9. U.S. Department of Energy, "Cap88–PC User's Guide," June 1997 (ER–8/GTN).

10. International Commission on Radiological Protection, "Recommendations of the ICRP," Publication 26, Pergammon Press, Oxford, 1977.

11. International Commission on Radiological Protection, "Limits for Intakes by Workers," Publication 30, Pergammon Press, Oxford, 1979.

12. Nuclear Fuel Services, Inc., "Applicants Environmental Report for Renewal of Special Nuclear Material License No. SNM–124," LIC–01–02, December 1996.

13. Nuclear Fuel Services, Inc., "Dose Factors and Action Levels for Waste Water Treatment Facility Radioactive Liquid Effluents," Revision 0, No. 21T–01–0728, HEA–21, July 11, 2001.

14. Gleckler, B.P., Nuclear Fuel Services, Inc., Phone conversation with P. LaPlante, Center for Nuclear Waste Regulatory Analyses, April 24, 2002.

15. National Council on Radiation Protection, "Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground," Report 123, 1996.

16. Maxin, A.M., Nuclear Fuel Services, Inc., Letter to R.C. Pierson, U.S. Nuclear Regulatory Commission, "License Renewal Application," License SNM–124, July 24,

1996 (with updates to present).

17. Andrews, Mark, Tennessee DEC, Division of Radiological Health, Letter to Maurice Carson, Manager of Studsvick Processing Facility, LLC, RE: Inspection Report for License No. R-86011-K06, p. 15, November 16, 2001.

6. REGULATORY CONSULTATION

During the preparation of the EA, various State and federal agencies were contacted. These contacts are summarized in Table 6.1.

Table 6.1 Information consultations

Agency	Point of Contact	Date	Purpose
Tennessee Historical Commission, Division of Archaeology	Jennifer Bartlett, Federal Programs Archaeologist	May 22, 2002	Discuss proposed BLEU Project amendments and determine if the Tennessee Historical Commission had any concerns about potential historic and/or archaeological impacts.
Fish and Wildlife Service	Lee Barclay, Field Supervisor	June 6, 2002	Discuss proposed BLEU Project amendments and determine if the Fish and Wildlife Service had any concerns about potential impacts to biota.
State of Tennessee, Department of Environment and Conservation, Division of Radiological Health	Debra Schults, Director	May 31, 2002	Discuss proposed BLEU Project amendments and determine if the TDEC Division of Radiological Health had any concerns abut potential environmental impacts.

APPENDIX A

DEMOGRAPHIC INFORMATION

Table A–1 Selected demographic characteristics for state and local geographic areas in the vicinity of the NFS facility at Erwin, Tennessee

Political Unit/ Geographic Area	Total Population	African American (percent)	American Indian (percent)	Asian (percent)	Native Hawaiian (percent)	Hispanic or Latino (percent)	Other (percent)	Two or more races (percent)
Tennessee	5,689,283	932,809 (16.4%)	15,152 (0.3%)	56,662 (10.0%)	2,205 (0.04%)	123,838 (2.2%)	56,036 (1.0%)	63,109 (2.1%)
Unicoi County	17,667	12 (0.07%)	44 (0.25%)	15 (0.08%)	5 (0.03%)	342 (1.9%)	167 (0.95%)	117 (0.66%)
City of Erwin	5,610	3 (0.05%)	16 (0.29%)	6 (0.11%)	0 (0%)	112 (2.0%)	57 (1.0%)	43 (0.77%)
City of Banner Hill (unincorporated)	1,053	4 (0.38%)	0 (0%)	0 (0%)	3 (0.28%)	4 (0.38%)	1 (0.09%)	5 (0.47%)
1-mile (1.6 km) radius[a]	4,104	3 (0.07%)	9 (0.22%)	1 (0.02%)	3 (0.07%)	135 (3.3%)	1 (0.02%)	26 (0.63%)

[a] Includes total population and minority populations for Block Groups adjacent to the NFS facility. U.S. Census Tract 802, Block Groups 2 and 4, and U.S. Census Tract 801, Block Group 1.

Source: U.S. Census Bureau 2000, Summary File 1 (SF 1) 100-Percent Data, American Factfinder (http://factfinder.census.gov).

Table A–2 Household income and population percentage in poverty for the four-Tennessee county ROI

Political Unit/ Geographic Area	Median Household Income (1998 Model-Based Estimate)	Percentage of All Ages in Poverty (1998 Model-Based Estimate)
Tennessee	$34,188	13.1
Carter County	$27,899	16.0
Sullivan County	$34,362	12.7
Unicoi County	$30,165	14.0
Washington County	$33,965	12.5

Source: U.S. Census Bureau, Housing and Household Economic Statistics Division, Small Area Estimates Branch (December 20, 2001) (http://www.census.gov/hhes/www/saipe/stcty/estimate.html).

APPENDIX B

GROUNDWATER MONITORING RESULTS

Table B–1 ^{99}Tc (pCi/L)[a] data for upgradient, crossgradient, and downgradient monitoring wells and piezometers

	Upgradient		Crossgradient					Downgradient				
Sampling Period	Well 234-2	Well 234-3	Well 39	Well 70A	Well 38	PZ 1	PZ 2	PZ 3	Well 100A	Well 100B	Well 101A	Well 102A
Jan-2000	ND	ND	18	ND	6495	ND	ND	ND	21	26	18	23
Feb-2000	ND	ND	U-6	ND	6391	ND	ND	ND	U13	U-16	U-26	U-15
Mar-2000	ND	ND	U7	ND	10807	ND	ND	ND	U10	U3	U5	U11
Apr-2000	113	U54	U36	ND	5287	217	80	80	80	U33	U32	U36
May-2000	80	80	80	ND	10064	80	80	80	80	80	80	80
Jun-2000	201	80	80	ND	3111	80	80	U43	80	80	80	80
Jul-2000	80	80	80	ND	5228	142	80	U65	80	80	80	80
Aug-2000	80	80	80	ND	3672	U42	80	U42	80	80	80	80
Sep-2000	513	U46	U35	ND	4692	U79	112	132	U30	U34	U38	U36
Oct-2000	155	U46	80	ND	3009	U50	114	104	U20	80	80	80
Nov-2000	80	U76	80	ND	2363	80	80	80	80	80	80	80
Dec-2000	419	U24	U28	ND	2864	U34	118	112	80	80	80	80
Mean	191	63	50	ND	5332	89	892	82	55	53	52	54
Std. Dev.	163	21	33	ND	2751	57	17	30	32	38	38	34
No. Obs.	9	9	12	0	12	9	9	9	12	12	12	12
95% UCL	292	76	67	ND	6758	125	102	101	71	72	72	72

[a] To convert pCi/L to kBq/m^3, multiply by 0.037.

ND = No Data
U = Below lab detection limits.
MCL = 900 picocuries per liter (pCi/L)

Negative values indicate activity was below system blank.

Source: Nuclear Fuel Services, Inc., "Additional Information to Support an Environmental Review for the BLEU Project," January 15, 2002.

Table B-2 Groundwater monitoring wells for gross alpha (pCi/L)[a] in the alluvial aquifer (Zones 1 and 2) for the vicinity of the surface impoundments

	Upgradient Well	Downgradient Wells		
Year-Quarter	52	101A	102A	103A
1996-3	2.1	4.1	1.3	2.2
1996-4	0.9	1.5	1.0	1.3
1997-1	2.1	2.6	1.1	1.1
1997-2	1.2	2.2	1.6	2.4
1997-3	0.6	1.5	0.8	0.8
1997-4	0.7	1.4	0.7	0.4
1998-1	0.9	1.9	1.0	1.2
1998-2	1.1	1.8	0.7	1.0
1998-3	0.6	1.3	1.1	0.8
1998-4	1.5	2.6	1.0	1.1
1999-1	0.8	2.8	-0.2	-0.3
1999-2	2.1	3.4	1.0	3.0
1999-3	-0.7	4.7	-1.0	0.0
1999-4	1.0	4.7	0.5	2.0
2000-1	0.7	2.0	-0.3	1.0
2000-2	-0.3	2.3	1.7	2.0
2000-3	1.7	3.7	1.3	2.0
2000-4	-0.3	3.7	1.0	3.0
2001-1	1.3	1.7	1.0	2.0
2001-2	0.3	3.0	-0.3	2.0
2001-3	1.0	2.3	-0.7	0.0
2001-4	-1.0	4.3	0.3	-1.0

[a] To convert pCi/L to kBq/m3, multiply by 0.037.

Source: Nuclear Fuel Services, Inc., "Response to a Request by NRC for Additional Information Concerning NFS' 1996 License Renewal Request," License SNM-124, Docket No. 70-143, June 17, 1997.

Nuclear Fuel Services, Inc., "NFS Response to NRC's Request for Additional Information to Support an Environmental Review for the BLEU Project," March 15, 2002.

Table B-3 Groundwater monitoring wells for gross beta (pCi/L)[a] in the alluvial aquifer (Zones 1 and 2) for the vicinity of the surface impoundments

	Upgradient Well	Downgradient Wells		
Year-Quarter	52	101A	102A	103A
1996-3	4.7	14.2	10.8	11.5
1996-4	7.8	8.2	11.2	14.9
1997-1	13.9	15.9	16.6	12.7
1997-2	16.4	16.2	13.8	10.7
1997-3	6.4	10.7	3.7	4.1
1997-4	3.9	8.1	4.6	4.8
1998-1	6.7	6.1	5.6	4.7
1998-2	0.1	7.7	-0.4	7.9
1998-3	6.9	18.5	11.6	4.7
1998-4	5.7	7.1	5.3	6.3
1999-1	8.0	9.8	-1.2	6.3
1999-2	7.2	25.0	3.0	7.0
1999-3	0.0	28.7	3.0	1.0
1999-4	4.0	23.7	5.0	3.0
2000-1	3.0	19.7	5.0	3.0
2000-2	3.3	22.7	4.3	6.0
2000-3	4.3	23.3	2.7	6.0
2000-4	1.7	28.7	7.3	4.0
2001-1	3.7	18.7	6.0	6.0
2001-2	4.3	17.3	4.3	8.0
2001-3	1.3	19.3	3.0	3.0
2001-4	0.3	34.0	3.3	1.0

[a] To convert pCi/L to kBq/m3, multiply by 0.037.

Sources: Nuclear Fuel Services, Inc., "Response to a Request by NRC for Additional Information Concerning NFS' 1996 License Renewal Request," License SNM-124, Docket No. 70-143, June 17, 1997.

Nuclear Fuel Services, Inc., "NFS Response to NRC's Request for Additional Information to Support an Environmental Review for the BLEU Project," March 15, 2002.

Table B–4 Monitoring wells by zone and groundwater model layer at the NFS Erwin Plant

Model Layer 1 Shallow Alluvium Zone	Model Layer 2 Cobble/Boulder Zone	Model Layer 3 Shallow Bedrock Zone	Model Layers 1, 2, and 3[a]	Model Layers 2 and 3[b]
Well 39	Well 38R	Well 60 B	Well 74	Well 60
Well 52	Well 63B	Well 67		Well 62
Well 55	Well 66	Well 67B		
Well 55A	Well 70A	Well 71		
Well 57	Well 91	Well 100B		
Well 58	Well 92	Well 107B		
Well 63	Well 93	Well 118B		
Well 63A	Well 94	Well 120B		
Well 64	Well 97A	Well 121B		
Well 68	Well 100A	SC-1		
Well 75	Well 102A	SC-3		
Well 95A	Well 108A	SC-4		
Well 98A	Well 111A			
Well 99A	Well 116A			
Well 101A	Well 116B			
Well 103A	Well 117A			
Well 104A	Well 117B			
Well 105A	Well 118A			
Well 106A	Well 119A			
Well 107A	Well 120A			
Well 234-2	Well LD-1A			
Well 234-3	Well LD-2A			
PW-1	Well IW-1			
PW-2	Well OW-1			
PW-3				
PW-4				
PW-5				
PW-6				
PW-7				
PW-8				
PW-9				
PW-10				
P-1				
P-2				
P-3				

[a] Well screen crosses shallow alluvium zone, cobble/boulder zone, and shallow bedrock zone.
[b] Well screen crosses cobble/boulder zone and shallow bedrock zone.

Sources: ARCADIS Geraghty & Miller, Inc., "Revised Groundwater Flow and Solute-Transport Modeling Report," Nuclear Fuel Services, Inc., Erwin Tennessee, February 1999.

Nuclear Fuel Services, Inc., Environmental Database Management System.

Nuclear Fuel Services, Inc., "Additional Information to Support an Environmental Review for the BLEU Project," January 15, 2002.

APPENDIX C

EFFLUENT PERMIT LIMITS

Table C–1 NPDES permit limits for nonradiological constituents (mg/L)[a] in the WWTF discharge at Outfall 001

Parameter	NPDES[b] Limit (Daily Maximum)
pH	Range 6.0–9.0
Flow	Report
Chemical Oxygen Demand	370
Total Suspended Solids	40
Settleable Solids	0.5
Chlorine, Total Residual (TRC)[c]	2.0
Fluoride, Soluble	20
Ammonia (as Nitrogen)	30
Nitrite plus Nitrate Nitrogen	558 lbs/day
Uranium, Natural, Total	4.0
Arsenic, Total	Report
Cadmium, Total	0.01
Chromium, Total	Report
Copper, Total	1.0
Lead, Total	0.1
Mercury, Total[d]	0.05
Nickel, Total	Report
Silver, Total	0.05
Zinc, Total	Report
Tetrachloroethylene	Report

[a] All values in mg/L except where specified; to convert L to m^3, multiply by 0.001; to convert lbs to kg, multiply by 0.454.
[b] NPDES—National Pollutant Discharge Elimination System.
[c] The total residual chlorine limit is only applicable when chlorine is used in the treatment process
[d] The chronic mercury limit shall apply only if the discharge of batches containing mercury occur four (4) or more consecutive days/week during the monitoring period; otherwise, only the daily maximum limit for batches containing mercury shall apply. If any individual analytical test result for mercury is less than the minimum quantification level (0.0002 mg/l), then a value of zero (0) may be used for discharge monitoring report calculations and reporting requirements.

Source: Nuclear Fuel Services, Inc., "Additional Information to Support an Environmental Review for BLEU Project," Docket No. 70-143, January 15, 2002.

Table C–2 Publicly owned treatment works permit limits for nonradiological constituents (mg/L)[a] in liquid effluent discharged to the sanitary sewer

Parameter	Daily Max	Average Discharge Limits
Cadmium	0.024	0.012
Total Chromium	0.564	0.423
Copper	0.768	0.384
Lead	0.593	0.445
Nickel	0.490	0.245
Silver	0.076	0.038
Zinc	0.493	0.369
Cyanide	0.170	0.114
Phenol	0.457	0.228
pH	Range 5.0—9.0	Range 5.0—9.0
Oil and Grease		100
Toluene	0.193	0.145
Benzene	0.114	0.057
1, 1, 1, Trichloroethane	0.193	0.096
Ethyl benzene	0.304	0.152
Carbon Tetrachloride	0.150	0.032
Chloroform	0.017	0.0084
Tetrachloroethylene	0.380	0.190
Trichloroethylene	0.030	0.015
1, 2, Trans-Dichloroethylene	0.380	0.190
Methylene Chloride	0.170	0.011
Naphthalene	0.076	0.038
Total Phthalates	0.935	0.468
Mercury	0.0048	0.0024
Temperature	40 °C (104 °F)	—

[a] All values in mg/L except for pH and temperature. To convert L to m^3, multiply by 0.001.

Source: Nuclear Fuel Services, Inc., "Additional Information to Support an Environmental Review for BLEU Project," Docket No. 70-143, January 15, 2002.

APPENDIX D

HISTORICAL ENVIRONMENTAL MONITORING RESULTS

Table D-1 Radioactivity in environmental air, soil, vegetation, sediment, and surface water[a]

Air Locations (μCi/mL)		Average Annual Concentration[b] 1996	1997	1998	1999	2000
Burial Ground NE Corner[c]	300 m, N	3.6×10^{-15}	4.3×10^{-15}	3.8×10^{-15}	4.0×10^{-15}	3.2×10^{-15}
Banner Hill Road at N Parking Lot	300 m, ESE	3.0×10^{-15}	3.9×10^{-15}	3.8×10^{-15}	2.4×10^{-15}	2.5×10^{-15}
Stalling Lane	315 m, SE	3.0×10^{-15}	3.9×10^{-15}	3.6×10^{-15}	2.8×10^{-15}	4.0×10^{-15}
Highland Avenue at 1st Street	405 m, S	2.9×10^{-15}	4.1×10^{-15}	3.7×10^{-15}	2.7×10^{-15}	3.8×10^{-15}
Spar Mill Road	540 m, ENE	5.3×10^{-15}	3.7×10^{-15}	3.4×10^{-15}	2.7×10^{-15}	3.8×10^{-15}
Industrial Park at Images, Inc.	270 m, W	3.3×10^{-15}	3.9×10^{-15}	3.4×10^{-15}	2.8×10^{-15}	3.8×10^{-15}
Soil Locations (pCi/g)						
North NFS Mound at Sewer[d]	300 m, N	18.11	103.57	184.52	239.84	NM[e]
Banner Hill Road at N Parking Lot	300 m, ESE	3.30	4.23	3.70	13.31	17.98
Vegetation Locations (pCi/g)						
North NFS Mound at Sewer	300 m, N	1.31	0.34	0.37	12.30	NM[e]
Banner Hill Road at N Parking Lot	300 m, ESE	0.99	0.12	0.36	1.69	3.87
Sediment Locations (pCi/g)						
Banner Spring Branch Downstream[d]		49.97	59.43	82.13	88.04	60.70
Martin Creek Downstream		2.61	5.70	5.31	4.18	9.71
Nolichucky River Downstream		1.39	2.79	2.40	8.75	10.84
Surface Water Locations (pCi/l)						
Martin Creek Downstream		9.90	10.84	10.41	6.58	6.25

Table D-1 Radioactivity in environmental air, soil, vegetation, sediment, and surface water[a] (continued)

Air Locations (μCi/mL)		Average Annual Concentration[b] 1996	1997	1998	1999	2000
Nolichucky Rover Downstream		0.38	0.66	0.39	1.12	2.89

[a] All environmental data was obtained from the NFS Safety Department Semi-Annual Reports or the Environmental Database Management System (EDMS).

[b] Concentrations are of gross alpha radioactivity. To convert Ci to Bq, multiply by 3.7E+10; to convert L to m^3, multiply by 0.001.

[c] This station is actually located onsite, but is outside the NFS protected area. This location is also known as the "North NFS Mound at Sewer" location even though it is actually located in the burial ground along Banner Spring Branch.

[d] This location is actually onsite, but it is outside the NFS protected area.

[e] NM = not measured: Sampling from this location was stopped after 1999, because the area was decommissioned.

Source: Nuclear Fuel Services, Inc., "Supplemental Environmental Report for Licensing Actions to Support the BLEU Project," Docket No. 70-143, November 9, 2001.