U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF FEDERAL AND STATE MATERIALS AND ENVIRONMENTAL MANAGEMENT PROGRAMS

DIVISION OF WASTE MANAGEMENT AND ENVIRONMENTAL PROTECTION

DRAFT ENVIRONMENTAL ASSESSMENT FOR THE RENEWAL OF U.S. NUCLEAR REGULATORY COMMISSION LICENSE NO. SNM–124 FOR NUCLEAR FUEL SERVICES, INC.

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EXECUTIVE SUMMARY

On June 30, 2009, Nuclear Fuel Services, Inc. (NFS) submitted an application and accompanying environmental report to the U.S. Nuclear Regulatory Commission (NRC) to request renewal of special nuclear material (SNM) license SNM–124. Under the conditions of SNM–124, NFS operates a nuclear fuel fabrication facility located in Erwin, Tennessee. If granted as proposed, the renewed license would allow NFS to continue operations and activities at the site for a 40-year period. Among other licensed operations, NFS downblends high-enriched uranium (HEU) to produce low-enriched uranium (LEU) material – the latter of which is used as fuel for commercial nuclear reactors.

NRC staff prepared this draft environmental assessment (draft EA) following NRC regulations at 10 CFR Part 51 that implement the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. §4321), and NRC staff guidance in NUREG–1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." The purpose of this draft EA is to assess the potential environmental impacts of the proposed license renewal and any reasonable alternatives. Based on its final EA, the NRC staff will either (1) issue a finding of no significant impact (FONSI), or (2) determine that preparation of an Environmental Impact Statement (EIS) is warranted.

By its application, NFS is requesting authorization to continue the currently approved licensed activities at its Erwin, Tennessee, facility for a 40-year period. In accordance with the provisions of 10 CFR Part 70, the current license authorizes NFS to receive, possess, store, use, and ship SNM enriched up to 100 percent. Under this proposed action, NFS would continue production of reactor fuel for government operations and for commercial domestic operations. Current facility operations include:

- Producing fuel using high-enriched uranium (HEU);
- Recovering uranium from scrap generated internally or from other facilities;
- Enrichment blending of HEU with natural uranium to produce blended LEU materials (BLEU);
- Converting low-enriched uranyl nitrate to uranium dioxide powder;
- Recovering ammonia by converting ammonium diuranate liquid into ammonium hydroxide;
- Converting highly enriched uranium hexafluoride to other uranium compounds;
- Performing general services, laboratory support, and waste management ; and
- Conducting research and development.

NFS is also authorized under its NRC license to conduct specified onsite decommissioning activities.

In addition to NFS' proposed action to renew its license for 40 years, the NRC staff analyzed two alternatives: (1) the no-action alternative and (2) renewing the NFS license for 10 years.

Under the no-action alternative, NRC would not renew License SNM–124, and as a result, operations at the NFS site would be required to cease. Also, NFS would be required under 10 CFR 70.38 to submit a detailed site decommissioning plan, and facility decommissioning would begin upon NRC approval of that plan. NRC's review would address both the health and safety and the environmental aspects of the proposed decommissioning plan.

NRC also considered a 10-year license renewal period as an alternative, because the license was previously renewed for this time period. The NRC staff did not separately address the 10-year alternative throughout the Draft EA, because the staff determined that the site operations and the types of potential impacts during a 10-year license renewal period would be the same as for the proposed 40-year license renewal period.

The following table summarizes the NRC staff's preliminary findings regarding the potential environmental impacts for each of the three alternatives considered. Generally, in its NEPA evaluations, the NRC staff categorizes potential impacts as follows:

- SMALL—environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource
- MODERATE—environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource
- LARGE—environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource

Table ES-1 Summary of Potential Environmental Impacts

Resource Area	Proposed Action	10-Year Renewal	No-Action
Land Use	SMALL	SMALL	MODERATE
Transportation	SMALL (overall) MODERATE (local)	SMALL (overall) MODERATE (local)	SMALL (overall) MODERATE (local)
Socioeconomics	SMALL	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	SMALL
Water Resources – Surface Water	SMALL	SMALL	SMALL to MODERATE
Water Resources – Groundwater	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Geology & Soils	SMALL (geology) SMALL to MODERATE (soils)	SMALL (geology) SMALL to MODERATE (soils)	SMALL (geology) MODERATE (soils)
Ecology	SMALL	SMALL	SMALL to MODERATE

Table ES-1 Summary of Potential Environmental Impacts			
Resource Area	**Proposed Action**	**10-Year Renewal**	**No-Action**
Noise	SMALL	SMALL	SMALL to MODERATE
Historic & Cultural	SMALL	SMALL	SMALL
Scenic & Visual	SMALL	SMALL	MODERATE
Public & Occupational Health	SMALL	SMALL	SMALL
Public & Occupational Health – Accidents	SMALL to MODERATE	SMALL to MODERATE	SMALL
Waste Management	SMALL	SMALL	MODERATE

Based on its review of the proposed action relative to the requirements set forth in 10 CFR Part 51, the NRC staff has preliminarily determined that renewal of NRC license SNM-124, authorizing operations at NFS's nuclear fuel fabrication facility in Erwin, Tennessee for a period of 40 years will not significantly affect the quality of the human environment. The facility already exists, and no changes to the site or to facility operations are associated with the proposed license renewal. As such, the proposed action can be considered a continuation of impacts and was evaluated based on impacts from past operations. Gaseous emissions and liquid effluents are controlled and monitored by permit and are within regulatory limits for non-radiological and radiological components. Public and occupational radiological dose exposures are below 10 CFR Part 20 regulatory limits. Therefore, based on this preliminary assessment, an environmental impact statement is not warranted, and pursuant to 10 CFR Part 51.31, a Finding of No Significant Impact (FONSI) is appropriate.

Pursuant to 10 CFR 51.33(a), the NRC staff is making this draft EA and draft FONSI available for public review and comment. In doing so, the NRC staff has determined that (1) the NFS request to renew SNM-124 for a period of 40 years is without precedent, because, if granted, this would be the first 40-year license renewal for a Category I nuclear fuel fabrication facility, and (2) preparation of this draft EA and draft FONSI will further the purposes of NEPA. Comments on the draft EA and FONSI will be accepted through November 13, 2010. Based on the comments received, the NRC staff may determine that a final FONSI is appropriate or instead find that preparation of an EIS is warranted should significant impacts resulting from the proposed action be identified. The NRC staff's final determination will be noticed in the *Federal Register*.

ACRONYMS/ABBREVIATIONS

AOC	areas of concern
BLEU	blended low-enriched uranium
DDE	direct dose equivalent
EA	environmental assessment
EJ	environmental justice
EPA	U.S. Environmental Protection Agency
FWS	U.S. Fish and Wildlife Service
GAO	General Accounting Office
HEU	high-enriched uranium
LEU	low-enriched uranium
MEI	maximally exposed individual
NAAQS	national ambient air quality standards
NEPA	National Environmental Policy Act
NFS	Nuclear Fuel Services, Inc.
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
POTW	Publicly Owned Treatment Works
PSD	Prevention of Significant Deterioration
RAI	request for additional information
ROI	region of influence
SER	safety evaluation report
SNM	special nuclear material
SWMU	Solid Waste Management Units
TDEC	Tennessee Department of Environment and Conservation
TEDE	total effective dose equivalent
TVA	Tennessee Valley Authority
USGS	U.S. Geological Survey
USACE	U.S. Army Corps of Engineers
WWTF	waste water treatment facility

DRAFT ENVIRONMENTAL ASSESSMENT FOR THE RENEWAL OF U.S. NUCLEAR REGULATORY COMMISSION LICENSE NO. SNM–124 FOR NUCLEAR FUEL SERVICES, INC.

1.0 INTRODUCTION

1.1 License Renewal Request

On June 30, 2009, Nuclear Fuel Services, Inc. (NFS) submitted an application and accompanying environmental report (NFS, 2009a,b) to the U.S. Nuclear Regulatory Commission (NRC) to request renewal of special nuclear material (SNM) license SNM–124. Under the conditions of license SNM–124, NFS operates a nuclear fuel fabrication facility located in Erwin, Tennessee. If granted as proposed, the renewed license would allow NFS to continue operations and activities at the site for a 40-year period.

NRC staff has prepared this draft environmental assessment (draft EA) following NRC regulations at 10 CFR Part 51 that implement the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. §4321 *et seq.*), and pursuant to NRC staff guidance in NUREG–1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs" (NRC, 2003). The purpose of this document is to assess the potential environmental impacts of the proposed license renewal and any reasonable alternatives. Based on this draft EA, the staff has made a preliminary determination that renewal of NRC license SNM-124 for a period of 40 years will not significantly affect the quality of the human environment and that a finding of no significant impact (FONSI) should therefore be made. Alternatively, based on comments received on this draft EA, the staff may instead find that preparation of an Environmental Impact Statement (EIS) is warranted should significant impacts resulting from the proposed action be identified.

The NRC staff also is performing a detailed safety analysis of the NFS proposal to assess compliance with 10 CFR Parts 20 and 70, and will document its analysis in a safety evaluation report (SER). The final EA – or an EIS if warranted – and the SER will be the bases for the NRC decision whether to renew the license as proposed.

Pursuant to 10 CFR 51.33(a), the NRC staff is making this draft EA and draft FONSI available for public review and comment. In doing so, the NRC staff has determined that (1) the NFS request to renew license SNM-124 for a period of 40 years is without precedent, because, if granted, this would be the first 40-year license renewal for a Category I nuclear fuel fabrication facility, and (2) preparation of this draft EA and draft FONSI will further the purposes of NEPA.

1.2 The Proposed Action

By its application (NFS, 2009a), NFS requests authorization to continue licensed activities at its Erwin, Tennessee, facility for a 40-year period. In accordance with the provisions of 10 CFR Part 70, the current license authorizes NFS to receive, possess, store, use, and ship SNM enriched up to 100 percent. Under this proposed action, NFS would continue production of reactor fuel for government operations and for commercial domestic operations. Current facility operations include:

- Producing fuel using high-enriched uranium (HEU);
- Recovering uranium from scrap generated internally or from other facilities;
- Enrichment blending of HEU with natural uranium to produce blended LEU materials (BLEU);
- Converting low-enriched uranyl nitrate to uranium dioxide powder;
- Recovering ammonia by converting ammonium diuranate liquid into ammonium hydroxide;
- Converting highly enriched uranium hexafluoride to other uranium compounds;
- Performing general services, laboratory support, and waste management ; and
- Conducting research and development.

NFS is also authorized under its NRC license to conduct specified onsite decommissioning activities.

Under the proposed action, NFS is proposing no changes to currently authorized operations and activities at the site. Should NFS decide to revise any of its current operations, a license amendment may be required and an environmental review and a safety analysis would be performed at that time. Site activities that are part of the proposed action are described in Chapter 2 of this document.

1.3 Need for the Proposed Action

As discussed in Section 1.2, NFS conducts a variety of activities at its Erwin facility. Renewal of license SNM–124 would allow NFS to continue these activities. The NFS site is presently the only facility that operates its classified processes for the government. Additionally, the NFS facility is one of only two facilities NRC licenses to downblend HEU to produce LEU material, which is used as fuel for commercial nuclear reactors (67 FR 2251, January 16, 2002).

1.4 Alternatives to the Proposed Action

1.4.1 No-Action Alternative

Under the no-action alternative, NRC would not renew license SNM–124. Operations at the NFS site in Erwin, Tennessee, would cease. NFS would be required under 10 CFR 70.38 to submit a detailed site decommissioning plan, and facility decommissioning would begin upon NRC approval of that plan. NRC's review would address both the health and safety and the environmental aspects of the proposed decommissioning plan.

Although specific steps may vary for the Erwin site, the basic process identified in a decommissioning plan would include ceasing operations; determining locations and concentrations of any radiological contamination; developing schedules, decommissioning procedures, and final survey methods to be used to demonstrate compliance with NRC criteria;

conducting the decontamination and decommissioning activities to achieve the applicable decommissioning standards; and disposing of decommissioning wastes (NRC, 2006). With NRC approval, NFS would begin decommissioning, and NRC would conduct onsite inspections and final confirmatory surveys to ensure that all activities are conducted in accordance with the plan (NRC, 2006).

1.4.2 Renewal for a 10-Year Term Alternative

NRC also considered a 10-year license renewal period as an alternative, because the license was previously renewed for this time period. The NRC staff did not separately address the 10-year alternative throughout the Draft EA, because the staff determined that the site operations and the types of potential impacts during a 10-year license renewal period would be expected to be the same as for the proposed 40-year license renewal period.

1.5 Scope of the Environmental Analysis

1.5.1 Federal and State Authorities

NRC authorizes NFS to conduct activities at the Erwin facility in accordance with the license conditions in SNM–124, issued under 10 CFR Part 70 (Domestic Licensing of Special Nuclear Material). As discussed in Section 1.1, in addition to this EA, NRC staff will prepare an SER. The SER will document NFS compliance with the provisions in 10 CFR Parts 20 and 70. In preparing these two documents, the NRC staff will have evaluated the potential impacts to public health and safety and the environment associated with the proposed continuation of licensed operations at the NFS site. Should the NRC issue a finding of no significant impact as a conclusion of this EA and determine in the SER that the licensed activities will be conducted to ensure public health and safety, the license would then be renewed. The NRC staff decision on the proposed action will be based on the results of both the EA and SER.

The U.S. Environmental Protection Agency (EPA), under its Resource Conservation and Recovery Act (RCRA) corrective action authorities, works with the Tennessee Department of Environment and Conservation (TDEC) to oversee NFS' activities to clean up surface and groundwater contamination at the site. Additionally, the EPA works with TDEC to regulate the management of certain solid hazardous wastes at the site. NFS's activities in these areas are conducted under permits issued by the EPA.

TDEC authorizes certain activities at the NFS site through the relevant State permitting processes. Under authorities delegated by the EPA, TDEC has issued permits to NFS that address surface water and stormwater discharge, and the discharge of air pollutants from boilers and other generating equipment. Additionally, in concert with the EPA, TDEC regulates the management by NFS of certain solid and hazardous wastes at the site.

Table 1-1 summarizes the various federal, state, and local agency licenses and permits issued to NFS for activities at its Erwin facility.

Table 1-1. Federal, State, and Local Agency Licenses and Permits for Activities at the NFS Site		
Issuing Agency	**Description**	**Status**
U.S. Nuclear Regulatory Commission (NRC)	Special Nuclear Material License	Renewal application under review
Tennessee Department of Environment and Conservation (TDEC)	National Pollution Discharge Elimination System (NPDES) Permit TN0002038	Expired 8/31/10; renewal application in 2010
	Tennessee Multi-Sector General NPDES Storm Water Permit (Tracking Number TNR053969 in 2010)	Active
TDEC	Aquatic Resource Alteration Permit (ARAP)	Active
TDEC	§401 Water Quality Permit for wetland fill and excavation	Active
U.S. Army Corps of Engineers (USACE)	USACE Section 404 Permit (discharge of dredge or fill material into the waters of the United States in accordance with Section 404 of the Clean Water Act)	Pending
USACE	Nationwide Permit 38	Active March 2010
U.S. Environmental Protection Agency (EPA)	Resource Conservation and Recovery Act (RCRA) Permit	Active
Erwin Utilities	Industrial Pretreatment Permits	Active
TDEC	Hazardous Waste Management Facility Permit	Active
EPA	Hazardous and Solid Waste Amendment Permit (mixed waste)	Active

For the purposes of its NEPA reviews, the NRC staff considers an NRC licensee's compliance with other federal and state permits to be protective of public health and safety, given the expectation that the various limits and conditions in the permits are reflective of the issuing agency's regulatory authority. For this reason, in this draft EA, the NRC staff does not review the adequacy of permit limits and conditions granted to NFS by other federal and state agencies, but rather identifies NFS' compliance with such permits as part of its assessment of potential impacts.

1.5.2 Basis for Review

The NRC staff has addressed the environmental impacts associated with the renewal of license SNM-124 and has documented the preliminary results of the assessment in this document. The staff performed this review in accordance with the requirements of 10 CFR Part 51.

The following documents were reviewed and considered in the development this draft EA:

- NFS license application dated June 30, 2009 (NFS, 2009a), and accompanying environmental report (NFS, 2009b);
- Previous NRC EAs for the NFS site (NRC, 1999; 2002);
- Information gathered from the NRC site visits, including information provided by stakeholders and NFS;
- NRC inspections reports for the NFS site;
- Effluent monitoring reports for the NFS site that NFS submitted in accordance with 10 CFR 70.59; and
- NFS responses to NRC requests for additional information (RAIs) (NFS, 2010a).

In this draft EA, the staff evaluates the impacts of continuing currently licensed operations at the NFS site for a period of 40 years and of reasonable alternatives. Note that many aspects of the proposed action and the affected environment have been addressed in previously issued NRC environmental review documents. For this reason, the staff uses information in prior EAs [e.g., for the previous license renewal (NRC, 1999), for the BLEU project (NRC, 2002)] as a basis; this draft EA focuses on new and significant information since those prior documents. Additionally, this draft EA focuses on changes to the affected environment, and the recent operating history to determine whether (i) there is new information that has not been previously evaluated and (ii) prior conclusions are still appropriate.

The staff's preliminary conclusions presented in this draft EA are based on all aspects of the proposed action and the affected environment, including those that have been evaluated in previous environmental documents. However, to limit redundancy and focus this draft EA on issues that have not been previously evaluated, staff refers readers to past environmental review documents (NRC, 1999, 2002) that contain more detailed descriptions of those aspects of analysis that remain unchanged.

1.5.3 Issues Outside the Scope of the EA

The NRC staff determined that the following listed areas were beyond the scope of this environmental assessment because (i) they were safety and enforcement issues or (ii) they were not within the NRC's regulatory authority. Many of the items found to be safety and/or enforcement issues are addressed in the SER.

- Material control and accountability
- Criticality safety controls
- Equipment failures
- Plant building stability
- Seismic risk analysis (likelihood)
- Safety culture

- Terrorism
- License violations
- NRC enforcement actions
- Requests for cancer studies

2.0 PROPOSED ACTION

This section describes the ongoing activities at the NFS site that comprise the proposed action analyzed in this draft EA. As discussed previously, NFS requests renewal of its NRC license for a period of 40 years. NFS has stated that the activities discussed here would be expected to continue during the renewal period (NFS, 2009b). Section 1.4 identifies two alternatives to the proposed action: a 10-year renewal of license SNM–124 and the no-action alternative. These alternatives are not detailed in this section, because (i) the activities expected under the 10-year license renewal would be the same as those under the proposed 40-year license renewal, and (ii) the no-action alternative involves activities that were discussed in section 1.4.1.

2.1 General Site Location and Description

The NFS site is situated on approximately 28 ha [70 acres] of land in Unicoi County, Tennessee, within the southwestern town limits of the Town of Erwin in Unicoi County, Tennessee. The property is located at latitude of 36°07'47"N and longitude of 82°25'57"W, approximately 499 to 512 m [1,640 to 1,680 ft] above sea level. The NFS site is bounded on the north by Martin Creek, on the south by residential properties along Carolina Avenue, on the southwest by Banner Hill Road, and on the northwest by CSX (formerly Carolina, Clinchfield, and Ohio) railroad tracks. Interstate 26 is less than 1.6 km [1 mi] from the site (Figure 2-1). The Nolichucky River is approximately 0.3 km [0.2 mi] from the site boundary (NFS, 2009a).

Four bodies of surface water are in the immediate vicinity of the plant. Banner Spring is a natural spring originating on the NFS property. Banner Spring forms Banner Spring Branch, which empties into Martin Creek at the site boundary. NFS enclosed Banner Spring Branch in an underground pipe in 2005. Martin Creek empties into Indian Creek 1,067 m [3,500 ft] north of the NFS site, and North Indian Creek then empties into the Nolichucky River.

Within the site boundary, a 10-ha [24-acre] fenced, protected area contains processing, support, and administrative office buildings. The remaining land area is used for parking, is in decommissioning, or remains undeveloped (NFS, 2009b).

2.2 Current Facility Use

The current facility use includes: (i) processing operations for the proposed action, the utilities, or support operations and (ii) ongoing decommissioning activities. The proposed action would involve renewing the license to authorize continuing operations, with the primary activities at the NFS site identified in section 1.2.

Those activities are supported by other operations, including:

- laboratory activities (e.g., wet chemical and physical testing);
- general services (e.g., storage, maintenance and repair of processing equipment, and decontamination of equipment and materials);
- research and development (e.g., working with SNM); and
- radioactive waste management (e.g., activities to process waste to reduce, reuse, package, and ship to proper disposal sites).

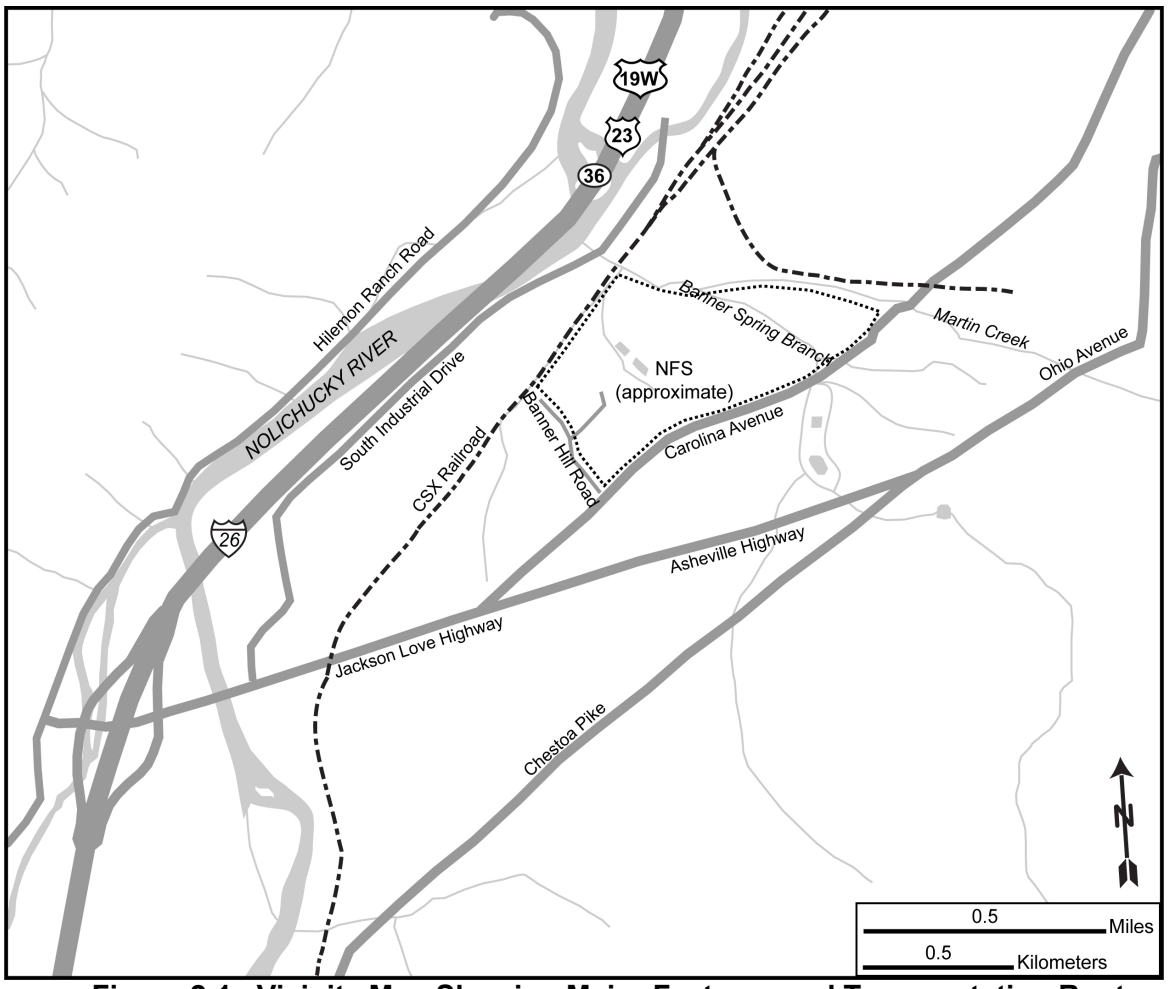

Figure 2-1. Vicinity Map Showing Major Features and Transportation Routes, Near the NFS Site

Decommissioning activities for certain approved areas of the site that are no longer being used are ongoing; the environmental impacts of these activities were previously analyzed in the 1999 license renewal EA (NRC, 1999). The North Site decommissioning is nearly complete, with the exception of removing contaminated soil from the North Site and beneath the former plutonium building wet cell (NFS, 2009b). An additional past area of soil contamination was in the southwestern portion of the NFS site. A historic evaluation indicated that this contamination originated from the storage of process equipment in the area during the 1960s (Moore, 2002a). The most highly contaminated soil has been removed, and residual soil contamination is above background but below levels established by NRC for the site to protect public health and safety (Moore, 2002b).

NFS intends to restart excavation of contaminated soil in the tent where the former plutonium building (Building 234) once stood (NFS, 2009c). NFS is identifying the major tools and equipment needed to start remediation activities. Remediation has not yet begun in this area; NFS currently plans to begin work on the project in 2010. NRC determined that a decommissioning plan was not required for this action and so no further environmental review was needed (NRC, 2010).

2.3 Waste Generated and Waste Management

The processes associated with the activities at NFS will generate gaseous, liquid, and solid wastes. This section describes the nature of these waste streams and waste management practices.

2.3.1 Effluents to Air

Under the proposed action, continuing operations would be expected to generate airborne effluents. These effluents would come mainly from the process stacks and from fugitive dust. Airborne effluents from process stacks are discharged currently and in the future in accordance with operating permits issued by the Tennessee Air Pollution Control Board and additionally are required to meet NRC radiological limits in 10 CFR Part 20. The operating air permits identify thresholds for emission rates for individual pollutants (i.e., maximum concentrations of pollutants that can be released into the environment over certain timeframes). In addition, these permits set conditions such as limiting the hours of operation or the rates that input materials or wastes can be processed. These permit conditions are implemented to control air emissions at levels that would comply with the thresholds established in the permit. NFS does not propose any changes in operations or facilities that would require modification of existing air permits. Fugitive dust would be created from activities associated with ongoing decommissioning and from the removal of contaminated soil at the North Site.

Radioactive particulates and chemicals from the effluents are primarily removed using venturi and demisting scrubbers and high-efficiency particulate air filtration. The scrubbers remove chemical compounds, and the high-efficiency particulate air filters remove particulates before their release through the NFS main stack.

Other filters/scrubbers are also used at the site, including: (i) American Society of Heating, Refrigerating, and Air Conditioning prefilters, which are used on heating, ventilation, and air conditioning recirculation room air handlers; (ii) packed-bed or sieve tray scrubbers that use sodium hydroxide, water, and sulfuric acid as solutions; and (iii) multiple high-efficiency particulate air filters that are used throughout the plant to achieve higher removal efficiencies.

Table 2-1 contains data for non-radiological gaseous pollutants that NFS activities emit. The table identifies the various pollutants, NFS' estimated annual emission level of each pollutant based on process knowledge, and the annual allowable emission limit for each pollutant under NFS' operating air permits issued by the State.

Table 2-1. Estimated and Allowable Annual Air Emissions (Mass)* of Air Pollutants†

Pollutant	Estimated Emissions	Allowable Emissions
Particulate	0.4 MT [0.5 T]	34 MT [38 T]
Sulfur dioxide	0.04 MT [0.05 T]	28 MT [31 T]
Carbon monoxide	4.1 MT [4.5 T]	5.7 MT [6.3 T]
Volatile organic compounds	1.2 MT [1.3 T]	4.3 MT [4.7 T]
Nitrogen oxides	17 MT [19 T]	52 MT [57 T]
Hydrogen fluoride	0.07 MT [0.08 T]	0.27 MT [0.3 T]
Hydrogen chloride	0.57 MT [0.63 T]	0.8 MT [0.9 T]
Vinyl chloride	0.00009 MT [0.0001 T]	0.009 MT [0.01 T]
Tetrachloroethylene	0.008 MT [0.009 T]	0.19 MT [0.21 T]

Table 2-1. Estimated and Allowable Annual Air Emissions (Mass)* of Air Pollutants†		
Pollutant	**Estimated Emissions**	**Allowable Emissions**
Trichloroethylene	0.0005 MT [0.0006 T]	0.05 MT [0.06 T]
Bis-2-ethylhexyphthalate	0.0006 MT [0.0007 T]	0.009 MT [0.01 T]
Mercury	0.0005 MT [0.0006 T]	0.009 MT [0.01 T]
Ammonia	22 MT [24 T]	103 MT [114 T]
Hydrogen	51 MT [56 T]	83 MT [92 T]
Nitric Acid	0.04 MT [0.05 T]	0.38 MT [0.42 T]
Hydrogen sulfide	0.009 MT [0.01 T]	0.018 MT [0.02 T]
Silicon tetrafluoride	0.009 MT [0.01 T]	0.06 MT [0.07 T]

*Metric tons abbreviated as MT, while short tons abbreviated as T.
†Modified from Nuclear Fuel Services, Inc. "Response to the Request for Additional Information Regarding the Environmental Assessment for Nuclear Fuel Services, Inc. Materials License SNM–124 Renewal." Docket No. 70-143. Erwin, Tennessee: Nuclear Fuel Services, Inc. May 2010.

NFS activities produce greenhouse gases. In October 2009, EPA promulgated the final rule for mandatory reporting of greenhouse gases. Under 40 CFR 98.30, Subpart C of this rule, NFS is classified as a stationary fuel combustion source. As required under this rule, NFS conducted an inventory to determine whether greenhouse gas emission levels exceeded the threshold requiring periodic reporting. NFS emits fewer than 25,000 metric tons [27,558 short tons] of CO_2 equivalents (CO_2e) and is not subject to mandatory reporting requirement at this time (NFS, 2010a). Section 3.4.2 of this draft EA contains background information on greenhouse gases.

2.3.2 Effluents to Water

Effluents to water are expected to be generated under the proposed action. Activities that contribute to these effluents include: fuel production, HEU recovery, uranium hexafluoride conversion, blending and laboratory operations, and decommissioning activities. Waste water from these activities is batch treated and sampled in and then discharged from the Waste Water Treatment Facility (WWTF). Prior to discharge, waste water is to be below limits set forth in 10 CFR Part 20 and in compliance with the facility's National Pollutant Discharge Elimination System (NPDES) permit (see Table 1-1). Generally, pre-discharge treatment involves (i) adjusting the pH level using sodium hydroxide or sulfuric acid and (ii) precipitating and removing fluoride ions and uranium by adding lime slurry ($Ca(OH)_2$). In addition, ammonia is removed using air stripping, and the pH is readjusted to ensure that the physical and chemical properties of the water are within the applicable limits to be discharged in the Nolichucky River (NFS, 2009b).

Sanitary wastes at the NFS site come from two sources. The first source is the NFS main facility, involving the onsite bathrooms and showers and the Groundwater Treatment Facility (GTF). The GTF handles groundwater collected onsite during ongoing decommissioning and reclamation activities. The second sanitary waste stream comes from the NFS BLEU complex. These wastes consist of noncontact cooling water, treated process waste water, and sanitary sewage. Waste streams from both sources are discharged separately under separate Erwin Utilities Publicly Owned Treatment Works (POTW) permits (see Table 1-1).

The primary pathway for surface runoff is from south to north across the plant site and first into Banner Spring Branch, then into other bodies of water (see Figure 2-1), and finally into the

Nolichucky River (NFS, 2009b). Surface runoff is sampled and discharged in accordance with an NPDES permit issued by the State (see Table 1-1).

Recent storm water discharge levels are provided in Tables 2-2 and 2-3. As shown, discharges have been within permit levels, except for nitrate/nitrite as nitrogen, total recoverable magnesium, and total recoverable aluminum. Elevated levels for these three constituents have been documented since at least 1999 (NFS, 1999). NFS believes that the nitrate/nitrite as nitrogen and total recoverable magnesium levels in the storm water are consistent with naturally occurring background levels in surface water and groundwater in the vicinity of the site, while the contributor for the elevated total recoverable aluminum is not known (NFS, 2003). No further correspondence between NFS and TDEC concerning resolution of this issue has been identified.

Table 2-2. 2007–2008 NFS Storm Water Data

Parameter	Monitoring Cut-Off Concentration (mg/l)	2007 NFS Outfall A (mg/l)	2008 NFS Outfall A (mg/l)	2007 NFS Outfall B (mg/l)	2008 NFS Outfall B (mg/l)
Chemical oxygen demand	120	70.3	57.4	17.2	91.3
pH	5.0–9.0	8.2	7.6	8.7	8.0
Total suspended solids	200	114	127	39.0	60.2
Nitrate + nitrite nitrogen	0.68	0.110	2.56	0.405	1.51
Ammonia	4	1.19	<0.030	0.264	0.780
Total recoverable magnesium	0.0636	4.94	18.9	2.40	2.70
Total recoverable aluminum	0.75	1.62	2.4	0.284	1.15
Total recoverable iron	5.0	2.30	2.15	0.210	1.19
Total recoverable cadmium	0.0159	0.00127	<0.001	<0.001	<0.001
Total cyanide	0.0636	<0.00150	0.00461	<0.00150	<0.0015
Total recoverable lead	0.156	<0.00507	0.00264	<0.0025	0.0073
Total recoverable mercury	0.0024	0.000112	<0.0003	<0.00006	<0.00003
Total recoverable selenium	0.2385	<0.006	<0.005	0.00771	0.0123
Total recoverable silver	0.0318	0.0014	<0.001	0.00141	<0.001
Total recoverable copper	0.0636	0.025	0.00948	0.00843	0.0684
Gross alpha (pCi/l)	NL*	117	39.9	9.07	15.0
Gross beta (pCi/l)	NL	28.9	18.1	4.86	15.9
Isotopic U-234 (pCi/l)	NL	64.4	30.2	7.22	10.5
Isotopic U-235 (pCi/l)	NL	1.84	1.43	0.312	0.544
Isotopic U-238 (pCi/l)	NL	7.74	1.06	<0.189	1.55
Temperature (°F)	NL	72.5	71.4	74.7	71.8
Visual observation	NL	Murky, suspended solids	Dark cloudy floating material	Clear, suspended solid	Dark cloudy floating material
Collection date	NL	6/19/07	8/25/08	6/19/07	08/25/08
Rainfall (in)	≥0.1	1.3	0.61	1.3	0.61

*NL—no permit limit

Table 2-3. 2007–2008 Blended Low-Enrichment Uranium Complex Storm Water Data			
Parameter	**Monitoring Cut-Off Concentration (mg/l)**	**2007 (mg/l)**	**2008 (mg/l)**
Nitrate/nitrite nitrogen	0.68	0.69	4.09
Total recoverable magnesium	0.0636	4.07	0.47
Total recoverable aluminum	0.75	2.29	0.109
Total recoverable iron	5	1.71	0.103
Total recoverable copper	0.0636	0.0037	0.00368
Gross alpha (pCi/l)	NL*	3.9	1.59
Gross beta (pCi/l)	NL	7.48	5.34
Isotopic U-234 (pCi/l)	NL	<0.330	<0.408
Isotopic U-235 (pCi/l)	NL	<0.451	<0.315
Isotopic U-238 (pCi/l)	NL	<0.330	<0.408
*NL—no permit limit			

2.3.3 Solid Waste Management

Under the proposed action, generation of radioactive, mixed, hazardous, and nonhazardous solid wastes is expected to continue. These wastes would be managed by a combination of onsite processing, permitted on-site storage, offsite disposal, and recycling. NFS has estimated the amounts of solid wastes that would be produced for the proposed 40-year license renewal period (NFS, 2010a)[1].

NFS produces radioactive solid waste, which is nonhazardous waste that is radioactive. Examples of radioactive wastes include process wastes and radioactively contaminated soil and sediment. This waste is packaged and sent to a licensed low-level radioactive waste facility for burial. Currently NFS sends waste to both the Nevada Test Site and to the EnergySolutions waste disposal facility in Clive, Utah. NFS estimates that the facility would produce approximately 101,000 m^3 [172,000 yd^3] of radioactive decommissioning waste, 27,000 m^3 [36,000 yd^3] of radioactive waste from commercial operations, and an additional 30 m^3 [39 yd^3] from other operational activities for a total of approximately 128,000 m^3 [208,000 yd^3] (NFS, 2010a) during for the 40-year license renewal period.

NFS produces hazardous waste (i.e., waste that poses substantial or potential threats to public health or the environment based on the waste's ignitability, reactivity, corrosivity, and toxicity). Examples of hazardous wastes include solid process wastes containing polychlorobenzene and tetrachloroethylene and laboratory wastes. Under the proposed action, NFS estimates the volume of hazardous waste generated to be 84 m^3 [110 yd^3] over 40 years of continued operations. NFS temporarily stores this type of waste onsite and then ships it offsite to an authorized treatment, storage, or disposal facility.

[1]Some of the NFS estimates of solid waste generation volumes were provided in gallons and were converted to cubic yards and cubic meters for consistency with solid volume measurements. Waste volumes generated for alternative action (10-year license renewal) would be approximately 25 percent of the volumes estimated for the 40-year license renewal. Similarly, annual waste volumes can be approximated by dividing the 40-year values by 40.

NFS also produces mixed waste, which is hazardous waste that is also radioactive. For the 40-year renewal period, NFS estimates that they would produce 204 m^3 [270 yd^3] of mixed waste. Presently, there is no permitted disposal facility for mixed waste. NFS has a Hazardous Waste Management Facility permit (issued by TDEC, Division of Solid Waste Management) and a Solid Waste Management Act permit (issued by EPA) that allow the facility to store specific kinds of mixed waste in onsite containers until a permitted facility is available. Most of the mixed waste is radioactive waste contaminated with mercury from laboratory operations. Much smaller amounts of other mixed wastes (including radioactively contaminated lead, pyridine, and tetrachloroethylene [TCE]) are also stored. NFS also stores polychlorobenzene (PCB) liquid waste that is radioactively contaminated, although this type of waste is no longer expected to be produced.

Finally, NFS generates nonhazardous solid waste. Examples this type of waste produced at the NFS site include waste oil, paper, and cafeteria waste. For the 40-year renewal period, NFS estimates the volume of nonhazardous solid waste to be 410 m^3 [530 yd^3]. All of these materials are recycled and/or disposed of at appropriate facilities.

2.3.4 Transportation

Under the proposed action, facility-related transportation activities involving local roads (e.g., commuting workers, shipments of supplies, products, and waste materials) would continue. Table 2-4 provides the magnitude of these road transportation activities associated with current operations. In addition to road transportation, NFS uses a rail line adjacent to the facility to support licensed activities including radioactive waste shipments.

Table 2-4. Estimated Vehicle Traffic Associated with NFS Activities

Cargo	Estimated One-Way Vehicle Traffic	Units	Remarks
Employee Commuting	1,662	Daily	831 NFS Employees in the Region of Influence*; Two Trips Per Day Per Employee Assumed
Radioactive Materials Shipments	267	Annually	NFS Estimate†
Hazardous Materials Shipments	74	Annually	NFS Estimate†
Nonhazardous Shipments	204	Annually	NFS Estimate†
Partial Site Decommissioning Wastes	1,732	For 40-Year Renewal Period	NFS Estimate†

*NFS. "Environmental Report." SNM License No. 124. Docket No. 70-143. Erwin, Tennessee: NFS. May 2009.
†Elliott, M. "Response to the Request for Additional Information Regarding the Environmental Assessment for Nuclear Fuel Services, Inc. Material License SNM–124 Renewal." Letter (May 27) to Director, NMSS (NRC). Erwin, Tennessee: NFS. 2010.

2.4 Monitoring Programs

NFS evaluates health and environmental impacts through monitoring compliance with applicable federal and state regulations. These programs include effluent and environmental monitoring. Radiological and non-radiological contaminants are produced from gaseous, liquid, and solids effluents from NRC-licensed activities as described previously. NFS also has a program to keep radiological exposures and effluents as low as reasonably achievable (ALARA). As necessary, NFS may adapt the ALARA program to address new-found information.

NFS conducts an environmental monitoring program that includes air, groundwater, surface water, soil, sediment, and vegetation sampling for radioactive content. This program is part of the conditions established under NFS's NRC license SNM-124. Action levels and collection frequency vary by sampling type. Should sample measurements exceed certain thresholds, NFS investigates the exceedance, implements corrective actions, and notifies the appropriate regulatory authority. The NFS environmental monitoring program is described in more detail in its license renewal application (NFS, 2009a) with environmental monitoring results for the various sampling types found in the accompanying environmental report (NFS, 2009b).

Air samples are analyzed for radioactive contaminants. NFS monitors and samples for gross alpha and gross beta radiation all process stacks and vents with the potential to release airborne radioactivity at concentrations greater than or equal to 10 percent of the values in 10 CFR Part 20, Appendix B, Table 2, Column 1. Radionuclides expected in airborne effluents are listed in Table 2-5. Air samples are analyzed for isotopic uranium on a quarterly basis, and isotopes of concern are measured annually.

Table 2-5. Radionuclides in Effluents at the NFS Site*

Radionuclide	Air Effluents	Liquid Effluents
Na-22		X
Tc-99	X	X
Cs-137		X
Pb-212		X
Ra-224		X
Th-228	X	X
Th-230	X	X
Th-231	X	X
Th-232	X	X
U-232		X
U-233		X
U-234	X	X
U-235	X	X
U-236		X
U-238	X	X
Np-237		X
Pu-238	X	X
Pu-239	X	X
Pu-240	X	X

Table 2-5. Radionuclides in Effluents at the NFS Site*		
Radionuclide	**Air Effluents**	**Liquid Effluents**
Pu-241	X	X
Am-241	X	X
* Ward, D.C. "Biannual Effluent Monitoring Report July Through December 2009." Letter (February 22) to Director, Office of Nuclear Material Safety & Safeguards, NRC. ML100700519. Erwin, Tennessee: Nuclear Fuel Services, Inc. 2010.		

Water samples are analyzed for radioactive contaminants. As discussed in section 2.3.2, waste water is treated and analyzed at the WWTF prior to discharge in the Nolichucky River. Discharges are below the NPDES permit limits and the constraints set forth in 10 CFR Part 20. Radionuclides expected in liquid effluents are listed in Table 2-3. A grab sample is taken quarterly from each batch at the WWTF and analyzed for gross alpha and gross beta radiation. In addition, a monthly composite sample is analyzed for uranium isotopes.

Sanitary sewer wastes are discharged through two pathways into the Town of Erwin POTW: the NFS sanitary sewer and the BLEU complex sanitary sewer. Both of these streams are sampled continuously for gross alpha and gross beta radiation and analyzed daily. In addition, both streams are continuously sampled for isotopic uranium and analyzed monthly. Grab samples of sludge are collected quarterly at the Town of Erwin POTW and analyzed for isotopic uranium to ensure radionuclides do not build up in the sewer sludge.

To determine compliance with solubility requirements for releases to the sanitary sewer specified in 10 CFR Part 20, NFS compares the results of the insoluble radioactivity measurements performed on the sanitary sewer samples to the amount of insoluble radioactivity present in similarly processed background samples. If insoluble radioactive materials are present at concentrations statistically greater than the concentrations measured in the background samples, discharges will be stopped and corrective actions taken.

NFS monitors the groundwater quality of its site on a quarterly basis by taking grab samples for gross alpha and gross beta activity and has established action levels. Eleven wells are monitored: one upgradient well and the other 10 wells are downgradient from the facility. If gross alpha activity in a well exceeds 33 dpm [15 pCi/L], then an analysis for isotopic uranium is performed. Isotopic plutonium and/or isotopic thorium analysis is performed when a well contains contaminants at levels significantly higher than background levels, or if potential contamination in the area indicates these analyses should be performed. If gross beta activity in any well exceeds 111 dpm [50 pCi/L], an analysis for Tc-99 is performed.

2.5 Employment

The number of individuals employed by NFS between 2004 and 2009 is provided in Table 2-6, along with NFS' projections of annual employment for the Years 2020 and 2050. As shown, NFS annual employment levels have increased between 2004 and 2009, and NFS anticipates modest changes in employment levels at the site with a loss or gain of employment on the order of 150 employees over the next 40 years (NFS, 2010a). Table 2-7 provides the distribution of NFS employees by county of residence. Most NFS employees reside in Washington and Unicoi Counties in Tennessee. The average income for NFS employees in 2005 was $95,613 including benefits and $57,032 excluding benefits (NFS, 2009b).

Table 2-6. NFS Annual Employment From 2004 to 2009 With Projections to 2050	
Year	**Number of Employees**
2004	715*
2005	711*
2006	695*
2007	730*
2008	831*
2009	829†
2020	680–980‡
2050	680–980‡

*NFS. "Environmental Report." SNM License No. 124. Docket No. 70-143. Erwin, Tennessee: NFS. May 2009.
†NFS. "NFS Facts." <http://www.nfsfacts.com/facts.html> Erwin, Tennessee: NFS. 2009. (April 2010).
‡ NFS. "Response to the Request for Additional Information Regarding the Environmental Assessment for Nuclear Fuel Services, Inc. Materials License SNM-124 Renewal." Docket No. 70-143. Erwin, Tennessee: NFS. 2010.

Table 2-7. NFS Employee Distribution by County of Residence*			
Region	**Year 2001**	**Year 2009**	**Change**
Washington County	264	356	+92
Unicoi County	252	249	−3
Carter County	52	116	+64
Sullivan County	44	50	+6
Greene County	NA†	17	NA†
Other‡	NA†	33	NA†
Total in the Region of Influence	612	788	+176
Total Number of Employees	653	829	+176

*NFS. "NFS Facts." <http://www.nfsfacts.com/facts.html> Erwin, Tennessee: NFS. 2009. (April 2010).
†NA: Not Available.
‡Includes other Tennessee Counties, North Carolina, and Virginia.

2.6 Anticipated Changes to Facility Over 40-Year Licensing Period

Because the availability of funds fluctuates with the renewal of existing contracts and obtaining new contracts, NFS does not plan for substantive maintenance activities beyond 5–10 years. Significant NFS infrastructure replacements and improvements planned during the next 5 years include (NFS, 2010a):

(1) Replace the Building 105 Lab heating, ventilation, and air conditioning system
(2) Replace the WWTF ammonia stripping tower
(3) Replace section(s) of the fire water supply line
(4) Replace the 134/134A electrical substations
(5) Construct a new shipping/receiving warehouse
(6) Construct a new entry/exit control point
(7) Construct new parking areas
(8) Complete the construction of security barrier walls
(9) Replace the process ventilation fans and Building 308 fan house
(10) Replace the main process ventilation stack
(11) Construct a new pipe bridge to relocate piping and utilities off Building 111

NFS plans to construct a retention pond to control storm water drainage during excavation and site preparation for the new warehouse, entry/exit control point, and parking areas (items 5, 6, and 7). Potential impacts from these construction activities would be controlled in accordance with the State of Tennessee storm water permit requirements.

3.0 AFFECTED ENVIRONMENT

3.1 Land Use

The NFS site is located in Unicoi County, Tennessee, within the southwestern town limits of Erwin, on Banner Hill Road and Carolina Avenue as shown in Figure 2-1. The facility is bounded on the north by Martin Creek, on the south by residential properties along Carolina Avenue, on the southwest by Banner Hill Road, and on the northwest by the CSX Railroad tracks. Interstate 26 is located beyond the railroad, northwest of the NFS property and less than 1.6 km [1 mi] of the site boundary.

NFS owns approximately 28 ha [70 acres]. About 80 percent of this acreage is used for process buildings, support facilities (e.g., warehouses, offices), parking lots, and waste management areas (Table 3-1), and about 10 ha [24 acres] lies within the fenced Plant Protected Area (NRC, 1999, 2002; NFS, 2009a). The remaining 20 percent of the acreage comprises open fields and undeveloped woodlands and shrub swamp. Since the last license renewal in 1999, NFS constructed the BLEU facility in 2002, comprising about 2.0 ha [5 acres] on the southern portion of the site (NRC, 2002). NFS indicates that there has been no additional change in land use within the site (NFS, 2009a,b) since 1999.

Land use within 1.6 km [1 mi] of the NFS site consists of a mix of residential, commercial, industrial, and agricultural activities (NFS, 2009b; ATSDR, 2007). The surrounding land is dominated by residential areas (Table 3-2), and about 2,800 people live within 1.6 km [1 mi] of the NFS site (NFS, 2010f).

Agricultural products in Unicoi County include vegetables, potatoes, berries, and tree fruit, as well as livestock, poultry, and dairy production (U.S. Department of Agriculture, 2009).

Table 3-1. Land Use on the NFS Site*

Use	Size ha [acres]	Percent of Site
Buildings and grounds	14.1 [34.7]	49.6
Former waste ponds and solid waste burial grounds	4.7 [11.6]	16.6
Woods, brush, and shrub swamp	4.2 [10.5]	15.0
Parking lots	3.9 [9.6]	13.8
Open fields	1.4 [3.5]	5.0
Total	28.3 [69.9]	100.0

*NFS. "Environmental Report." SNM License No. 124. Docket No. 70-143. Erwin, Tennessee: NFS. May 2009.

Table 3-2. Land Use Within 1.6 km [1 mi] of the NFS Site*

Land Use Category	Percent of Area
Residential	91.4
Commercial	5.9
Industrial	1.6
Farmlands	0.8
Mountainous forest	0.2
Total	100

*NFS. "Environmental Report." SNM License No. 124. Docket No. 70-143. Erwin, Tennessee: NFS. May 2009.

Agricultural production in the county in terms of both market value and the total number of farms has declined since 2002 (U.S. Department of Agriculture, 2009). Residential vegetable gardens are common (NFS, 2009b). The Erwin National Fish Hatchery, which produces and breeds rainbow trout for distribution (FWS, 2007), is located approximately 183 m [600 ft] upstream of the NFS site.

Currently, Unicoi County has 26 manufacturing companies, all of which are located within Erwin, Tennessee. Of these companies, the top five (based on number of employees) are NFS, Specialty Tires of America Inc., NN Inc., Vesuvius USA Corp., and Impact Plastics Corporation. Four of these companies (except for NFS) manufacture tires, metals, ceramic fibers and silica shrouds, and plastics (Tennessee Department of Economic and Community Development, 2008). Riverview Industrial Park, located across the railroad tracks on the west side of the NFS site, houses industrial facilities including AB Plastics, Impact Plastics Corporation, and Preston Tool and Mold. In addition, NFS stages low level radioactive waste at Riverview Industrial Park prior to shipping the waste to the disposal site via railroad. The CSX railroad tracks and Interstate 26 lie to the north and west as shown in Figure 2-1 (ATSDR, 2007). In April 2008, CSX Transportation, Inc. announced expansion plans for its Erwin terminal to accommodate anticipated increases in bulk freight shipments (CSX, 2008). Other nearby industrial facilities include Studsvik, a low-level radioactive waste processing facility licensed by the State of Tennessee, which is located adjacent to the NFS site southern boundary.

The Nolichucky River, located approximately 100 m [330 ft] north and west of the site boundary, is used primarily for recreational purposes such as whitewater rafting, canoeing, and fishing. The 9.6-km [6-mi] long Erwin Linear Trail, which runs parallel to the river and on the same side of the river as the NFS site, offers opportunities for walking, hiking, bicycling, enjoying arts and craft shows, and listening to outdoor concerts (Unicoi County, 2010a).

3.2 Transportation

The NFS site is accessed by roads and a CSX rail line. Carolina Avenue and Jackson Love Highway carry traffic from the plant to Interstate Highway 26 {a distance of approximately 2.6 km [1.6 mi]} and to the broader national interstate highway system (Figure 3-1). Table 3-3 provides traffic counts for roads near the NFS site. NFS uses the rail line to support licensed activities including radioactive waste shipments.

3.3 Socioeconomics and Environmental Justice

This section discusses socioeconomic conditions for the local region surrounding the NFS site. As shown in Figure 3-1, the local region includes five counties in Tennessee—Carter, Greene, Sullivan, Unicoi (containing the NFS site), and Washington. These counties are more likely to experience socioeconomic impacts given the location of the NFS site and that most NFS employees live in one of these counties, as shown in Table 2-5. Thus, these counties comprise the region of influence (ROI) for the socioeconomic analysis. Socioeconomic factors include demographics (the distribution of the population in the ROI), employment information (the number of persons employed and unemployed), income, housing, and education.

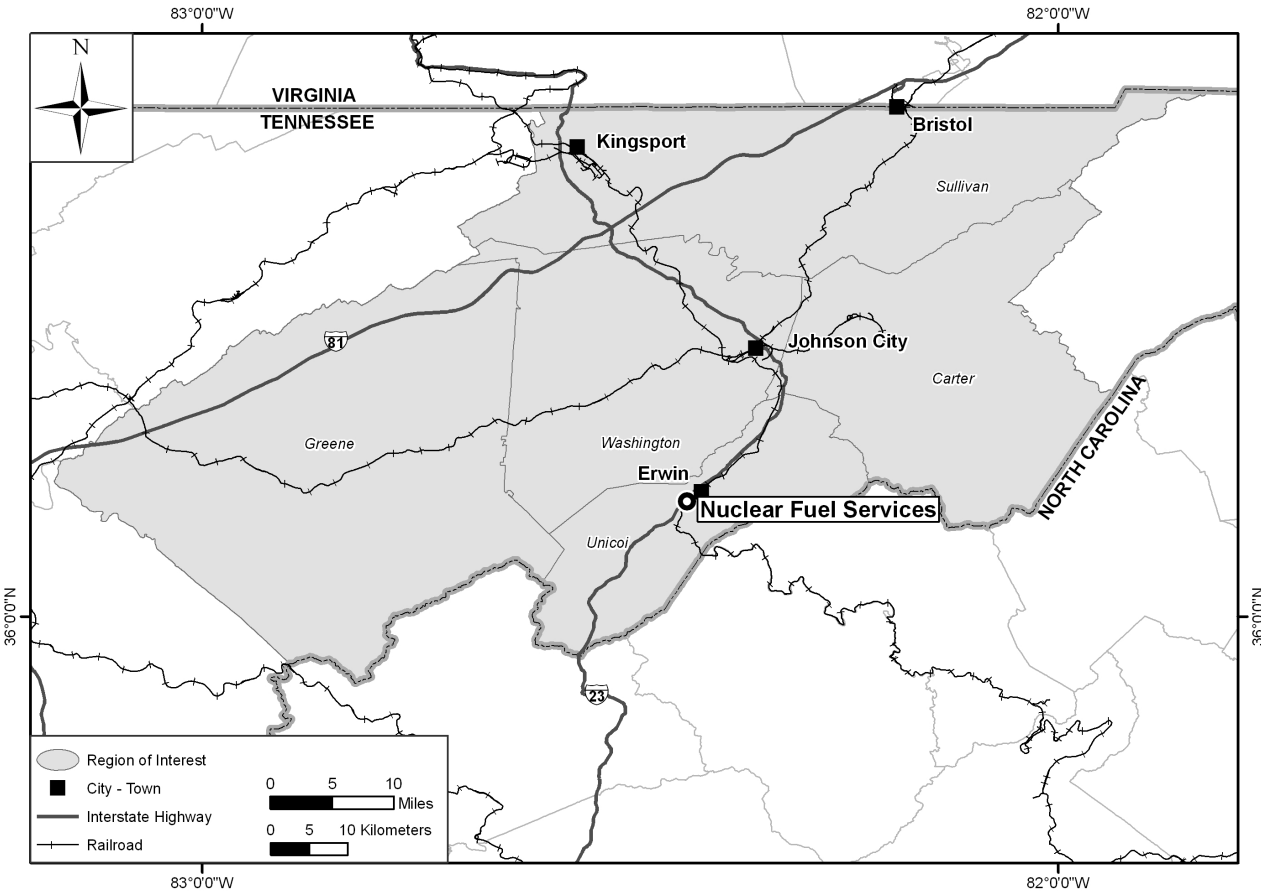

Figure 3-1. Map Showing Major Transportation Routes, Including Rail Routes, and the Five Counties in the Region of Influence in the Vicinity of the NFS Site

Table 3-3. Average Annual Daily Traffic Counts Near the NFS Site*				
Road and Location	**2005**	**2006**	**2007**	**2008**
Jackson Love Highway Between Carolina Avenue and Interstate 26, Erwin	8,388	7,793	7,989	7,604
South Main Avenue at Tucker Street, Erwin	9,598	8,412	8,047	7,560
State Highway 107 Between North Main Avenue and Interstate 26, Erwin	6,935	6,138	6,080	5,804
Interstate 26 West of Erwin	13,537	14,403	15,964	16,230
North Main Avenue Between 5th and 6th Streets, Erwin	10,724	8,977	8,387	8,272
*Tennessee Department of Transportation. "Traffic History GIS Map Interface Data for Unicoi County from 1985 through 2008." Nashville, Tennessee: Tennessee Department of Transportation. 2009. <http://ww3.tdot.state.tn.us/traffichistory/> (15 December 2009).				

3.3.1 Demographics

Demographics for the counties of interest are based on U.S. Census Bureau data, information from the Tennessee Advisory Commission on Intergovernmental Relations, and data from the North Carolina Demographics and Bureau of Economic Analysis. Table 3-4 contains the population distribution for each county, the State of Tennessee, and the towns of Johnson City and Erwin. As discussed previously, the NFS site is located in Erwin, and Johnson City is the largest city near NFS.

Sullivan County, which contains the cities of both Bristol and Kingsport (Figure 3-1), is currently the most heavily populated county and is projected to remain so through 2030. Washington County shows the largest increased percentage change in population as projected through 2030. The least populated county is Unicoi County, where the NFS site is located, and the county's population is expected to decline slightly from 2008 to 2030.

Overall, the estimated change in population for the counties of interest was much lower than the projected change in population for Tennessee from 2000 to 2030. This indicates that the ROI for this analysis is growing more slowly than the state population.

Table 3-4. Population Characteristics for Region of Influence*

Region	2000 Population Census	2008 Population Estimate	2000 to 2008 Percent Change	2030 Population Projection	Change in Population from 2008 to 2030
Carter County	56,740	59,492	+4.9%	67,816†	+14.0%
Greene County	62,909	66,157	+5.2%	73,024†	+10.4%
Sullivan County	153,050	153,900	+0.6%	143,378†	−6.4%
Unicoi County	17,667	17,718	+0.2%	17,561†	−0.9%
Washington County	107,198	118,639	+10.7%	137,005†	+15.5%
Total Region of Influence	397,564	415,906	+4.6%	438,784	+33,714
State of Tennessee	5,689,270	6,214,888	+9.2%	7,380,634‡	+1,167,546
Johnson City	55,469	59,866‡	+7.9%	70,353‡	+10,487
Erwin	5,610	5,802	+3.4%	5,608‡	−194

*U.S. Census Bureau. "State and County Quick Facts." 2009. <http://quickfacts.census.gov> (8 December 2009).
†Tennessee Advisory Commission on Intergovernmental Relations (TACIR). 2009. <http://www.state.tn.us/tacir/ population.html> (23 March 2010).
‡Based on 2006 population estimate.

Selected racial characteristics for the ROI are presented in Table 3-5. The U.S. Census Bureau defines race as a self-identification data item with which individuals most closely identify themselves. The data in Table 3-5 show low diversity in the five counties of interest, with the majority of the population identified as white. The data show that the racial characteristics for the ROI differ from those of the state of Tennessee as a whole.

Table 3-5. 2008 Racial Characteristics for the Region of Influence*

Region	White	African American	Native American	Two or More Races†	Asian	Native Hawaiian and Other Pacific Islander
Washington County Percent of Total‡	93.8%	4.1%	0.2%	1.1%	0.8%	<0.1%
Unicoi County Percent of Total‡	98.2%	0.7%	0.3%	0.7%	0.1%	<0.1%
Carter County Percent of Total‡	96.5%	1.9%	0.2%	0.9%	0.3%	<0.1%
Sullivan County Percent of Total‡	96.1%	2.3%	0.3%	0.8%	0.6%	<0.1%
Greene County Percent of Total‡	96.5%	2.3%	0.2%	0.7%	0.3%	<0.1%
Johnson City Percent of Total‡§	90.1%	6.4%	0.3%	1.3%	1.2%	<0.1%
Erwin Percent of Total‡§	97.8%	0.1%	0.3%	0.8%	0.1%	<0.1%
Tennessee Percent of Total‡	80.4%	16.8%	0.3%	1.1%	1.3%	0.1%

*U.S. Census Bureau. "U.S. Census Bureau State and County Quickfacts." 2009. <http://quickfacts.census.gov> (29 March 2010).
†Includes all other responses not included in the "White," "Black or African American," "American Indian and Alaska Native," "Asian," and "Native Hawaiian or Other Pacific Islander" race categories listed above. Includes multiracial, mixed, interracial, or a Hispanic/Latino group (for example, Mexican, Puerto Rican, or Cuban).
‡Percent of total may not total 100 due to rounding.
§Based on 2000 data.

3.3.2 Employment Information

Employment information for the ROI (i.e., the number of persons employed and unemployed) is shown in Table 3-6 for the counties in the ROI and the State of Tennessee. Within the ROI, Sullivan and Washington counties have had the highest labor force populations. However, the overall ROI experienced an increase in unemployment from 2008 to 2010. The 2008 and August 2010 unemployment rates show Greene County had the highest unemployment rate of the counties in the ROI. Overall, the unemployment rate in the ROI is consistent with the unemployment rate in Tennessee.

Table 3-6. Employment Structure by County Within the Region of Influence*						
Region	2008 Labor Force Population	2008 Number of Persons Unemployed	2008 Percent Unemployed	August 2010 Labor Force Population	August 2010 Number of Persons Unemployed	August 2010 Percent Unemployed
Washington County	61,618	3,372	5.5%	63,100	5,310	8.4%
Unicoi County	8,480	610	7.2%	8,460	770	9.1%
Carter County	29,781	1,917	6.4%	30,210	2,890	9.6%
Sullivan County	74,358	3,841	5.2%	75,640	6,010	7.9%
Greene County	30,370	2,773	9.1%	30,130	3,890	12.9%
Tennessee	3,050,000	204,000	6.7%	2,777,100	295,200	9.6%
Total ROI	204,607	12,513	6.1%	207,540	18,870	9.1%
* U.S. Bureau of Labor Statistics. <http://www.bls.gov/news.release/history/srgune_02232001.txt> and <http://ftp.bls.gov/pub/special.requests/la/laucnty08.txt, http://ftp.bls.gov/pub/special.requests/la/laucnty00.txt> (24 March 2010). http://www.tennessee.gov/labor-wfd/labor_figures/aug2010county.pdf (October 8, 2010)						

3.3.3 Income

Income information from U.S. Census Bureau data, including income and poverty levels for the affected environment, based on data collected from State and county levels, is presented in Table 3-7 for each county in the ROI for the State of Tennessee, and for Johnson City and Erwin.

The median household income in the ROI in 2006–2008 was below that of the state, with the highest income in Washington County. The percentage of families and persons living below the poverty level in the ROI in 2006–2008 was the highest in Carter and Greene Counties. Both of these counties had higher percentages of people living below the poverty level than did the state as a whole.

Table 3-7. Economic Data by County, State, and City Within the Region of Influence*					
Region	2006–2008 Median Household Income	2006–2008 Median Family Income	2006–2008 Families Below Poverty Level (Percentage)	2006–2008 Per Capita Income	2006–2008 Individuals Below Poverty Level (Percentages)
Carter County	$33,082	$40,696	16.9	$17,847	21.6
Greene County	$36,192	$42,381	15.8	$18,237	19.6
Sullivan County	$40,377	$52,108	11.3	$23,667	14.8

Table 3-7. Economic Data by County, State, and City Within the Region of Influence*					
Region	2006–2008 Median Household Income	2006–2008 Median Family Income	2006–2008 Families Below Poverty Level (Percentage)	2006–2008 Per Capita Income	2006–2008 Individuals Below Poverty Level (Percentages)
Unicoi County	$29,863	$36,871	8.7	$28,420 (2007)	13.1
Washington County	$41,023	$52,676	10.1	$23,621	15.2
State of Tennessee	$43,662	$53,653	11.9	$24,094	15.7
Johnson City	$38,205	$53,474	12.5	$24,624	19.2
Erwin†	$29,644	$37,813	7.5	$28,420 (2007)	13.0

*U.S. Census Bureau. "U.S. Census Bureau American Fact Finder." 2010. <http://factfinder.census.gov> (27 March 2010).
†Tennessee Department of Economic and Community Development. "Tennessee Community Data Sheet: Erwin." Erwin, Tennessee: Tennessee Department of Economic and Community Development. 2010.

3.3.4 Education

Education information is discussed for Unicoi and Washington Counties, and for the towns of Erwin and Johnson City, Tennessee, as the number of NFS employees is concentrated in these areas.

Unicoi County currently has four elementary schools, one middle school, and one high school. All of these schools are located in Erwin (Unicoi County Schools, 2010). Currently, the total school population for Erwin is 2,264 students with a student-to-teacher ratio of 16-to-1 (Local School Directory, 2010).

Washington County currently has 10 elementary schools, 2 middle schools, and 3 high schools (Washington County School District, 2010). Johnson City currently has 15 public schools. There are approximately 8,955 students with a student-to-teacher ratio of 15-to-1 (Local School Directory, 2010).

3.3.5 Environmental Justice

In 2004, NRC published a final policy statement on the treatment of environmental justice (EJ) matters in NRC regulatory and licensing actions (69 FR 52040; August 24, 2004). The policy statement provides that one of the first steps in the EJ analysis is to identify the geographic area for which to obtain demographic information. Current staff guidance in NUREG–1748 (NRC, 2003), which the 2004 policy statement affirms, provides that the potentially affected area is normally determined to be within a 0.97-km [0.6-mi] radius of the center of the proposed site in urban areas and 6.4 km [4 mi] if the facility is located in a rural area. Once the potentially affected area is identified, demographic data for the area are collected from the U.S. Census Bureau at the census block group level. The goal is to evaluate the "communities," neighborhoods, or areas that may be disproportionately impacted (NRC, 2003).

Census data are obtained to identify both minority and low-income populations, if present, and this is done by determining the percentages of these populations within each of the census block groups. These percentages are next compared to percentages at the county and state levels. If the percentage of the block groups significantly exceeds that of the state or county percentage for either minority or low-income population, EJ must be analyzed in greater detail. Generally, a difference of 20 percent or more, or alternately, a block group percentage of 50 percent or more, for either minority or low-income population is considered to be significant (NRC, 2003). If these percentages or differences in percentage are not present, then a detailed EJ review is not considered to be warranted.

For the purposes of this review, the NRC staff used the population, demographic, and economic data for the Town of Erwin, Unicoi County, and the State of Tennessee, provided in Tables 3-4, 3-5, and 3-7. As shown in those tables, there is not a significant difference in the percentages of minority or low-income populations in Erwin as compared to Unicoi County. Additionally, there is not a significant difference in the percentage of low-income population in Erwin as compared with the State of Tennessee, and the percentage of minorities in Erwin does not exceed that of the State. For these reasons, therefore, a detailed EJ review was not conducted.

3.4 Climatology, Meteorology, and Air Quality

3.4.1 Meteorology and Climatology

The region surrounding the NFS site typically experiences warm summers and relatively mild winters. The warmer, wetter weather is associated with the air masses originating over the Gulf of Mexico and the cooler, drier weather is associated with the polar continental air masses. A previous NRC EA for license renewal (NRC, 1999) relied on climate data from the Bristol Tri-City climate station located about 32 km [20 mi] northeast of the NFS site. This draft EA will also utilize data from the Erwin 1 W station, which is located in the same city as the NFS site. Figure 3-2 is a map showing the location of these two climate stations.

Table 3-8 contains climate data collected from 1971 to 2000. Erwin 1 W station data collected from 1971 to 2000 generated an annual mean temperature of 13.1 ˚C [55.6 ˚F] (National Climatic Data Center, 2002). On average, July is the hottest month and January is the coldest.

From 2001 to 2008 the average annual temperatures for this station ranged between 19.5 and 21.3 ˚C [67.1 and 70.3 ˚F] (National Climatic Data Center, 2009a). The Erwin 1 W station data collected from 1971 to 2000 generated an annual mean precipitation level of 116 cm [45.7 in] (National Climatic Data Center, 2002). As depicted in Table 3-8, this precipitation is fairly evenly distributed throughout the year. On average, July is the wettest month and October is the driest. From 2001 to 2008, the average annual precipitation for this station ranged between 84.96 and 134.3 cm [33.45 and 52.89 in] (National Climatic Data Center, 2009a). Bristol Tri-City station data collected from 1971 to 2000 generated an annual mean snowfall level of 38.3 cm [15.1 in]. Snowfall can be expected to start in October and end around April. Almost two-thirds of the snow falls in January and February (National Climatic Data Center, 2004).

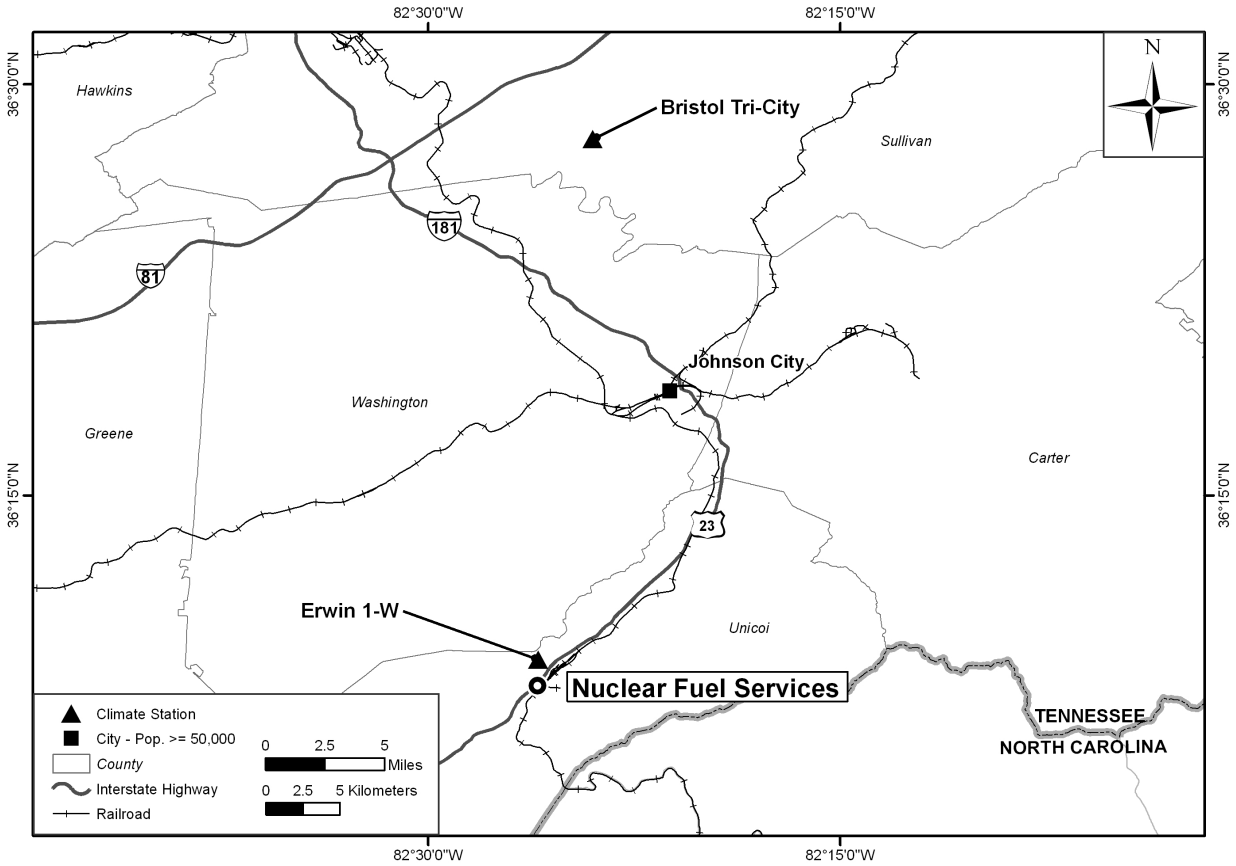

Figure 3-2. Map Showing Climate Station Locations for the Region Around the NFS Site

Table 3-8. Climate Data For the Region around the NFS Site from 1971 to 2000

Month	Erwin 1 W* Average Temperature	Erwin 1 W* Precipitation	Bristol Tri City† Snow
January	1.9 ˚C [35.5 ˚F]	8.61 cm [3.39 in]	14.2 cm [5.59 in]
February	4.0 ˚C [39.2 ˚F]	8.66 cm [3.41 in]	10.4 cm [4.09 in]
March	8.4 ˚C [47.1 ˚F]	10.3 cm [4.05 in]	4.8 cm [1.89 in]
April	12.6 ˚C [54.7 ˚F]	9.42 cm [3.71 in]	2.3 cm [0.90 in]
May	17.1 ˚C [62.8 ˚F]	13.9 cm [5.47 in]	0 cm [0 in]
June	21.4 ˚C [70.5 ˚F]	12.2 cm [4.80 in]	0 cm [0 in]
July	23.4 ˚C [74.1 ˚F]	14.8 cm [5.83 in]	0 cm [0 in]
August	22.9 ˚C [73.2 ˚F]	9.50 cm [3.74 in]	0 cm [0 in]
September	19.8 ˚C [67.6 ˚F]	8.61 cm [3.39 in]	0 cm [0 in]
October	13.5 ˚C [56.3 ˚F]	5.49 cm [2.16 in]	0.2 cm [0.08 in]
November	8.44 ˚C [47.2 ˚F]	6.96 cm [2.74 in]	0.8 cm [0.3 in]
December	3.94 ˚C [39.1 ˚F]	7.95 cm [3.13 in]	5.6 cm [2.2 in]
Annual Average	13.1 ˚C [55.6 ˚F]	116 cm [45.7 in]	38.3 cm [15.1 in]

*Modified from National Climatic Data Center. "Climatology of the United States No. 81: Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971–2000: 40 Tennessee." Asheville, North Carolina: National Oceanic and Atmospheric Administration. 2002.
†National Climatic Data Center. "Climatology of the United States No. 20: Monthly Station Climate Summaries, 1971–2000." Asheville, North Carolina: National Oceanic and Atmospheric Administration. 2004.

The prevailing wind direction is southwest. Data from the Kingsport, Tennessee, airport generated a 30-year average wind speed of 3.1 m/s [6.9 mph] (NFS, 2009b). Onsite wind speed data from 1991 to 1995 generated an average annual value of 3.4 m/s [7.6 mph] (NRC, 2002).

The Erwin region normally does not experience severe storms. The National Climatic Data Center Storm Event Database recorded one tornado and no hurricanes or tropical storms in Unicoi County from January 1, 1950, to January 1, 2009. This database recorded 84 events in Unicoi County during the same time period. The vast majority of events (70) can be roughly divided evenly into 2 categories: winter events (blizzards) and thunderstorm and/or wind events. The remaining categories consist of flood events (six) and hail events (eight) (National Climatic Data Center, 2009b).

3.4.2 Air Quality

EPA has established air quality standards to protect human health and welfare and to protect against damage to the environment and property. These standards include the National Ambient Air Quality Standards (NAAQS) that address six common air pollutants: carbon monoxide, nitrogen dioxide, particulate matter, ozone, and sulfur dioxide (Table 3-9). Regulations divide particulates into two categories: PM_{10}, defined as particulate matter smaller than 10 µm [3.9×10^{-4} in], and $PM_{2.5}$, defined as particulate matter smaller than 2.5 µm [9.8×10^{-5} in].

Table 3-9. National Ambient Air Quality Standards*

Pollutant	Primary Standard	Averaging Time	Secondary Standard
Carbon Monoxide	9 ppm	8 hours	None
	35 ppm	1 hour	None
Lead	0.15 µg/m^3 [4.1×10^{-9} oz/yd^3]	Rolling 3-month average	Same as primary
	1.5 µg/m^3 [4.1×10^{-8} oz/yd^3]	Quarterly average	Same as primary
Nitrogen Dioxide	0.053 ppm	Annual (Arithmetic Mean)	Same as primary
Particulate Matter (PM_{10})	150 µg/m^3 [4.1×10^{-6} oz/yd^3]	24 hours	Same as primary
Particulate Matter ($PM_{2.5}$)	15.0 µg/m^3 [4.1×10^{-7} oz/yd^3]	Annual (arithmetic mean)	Same as primary
	35 µg/m^3 [9.4×10^{-7} oz/yd^3]	24 hours	Same as primary
Ozone	0.075 ppm (2008 std)	8 hours	Same as primary
	0.08 (1997 std)	8 hours	Same as primary
Sulfur Dioxide	0.03 ppm	Annual (arithmetic mean)	None
	0.14 ppm	24 hours	None
	Not applicable	3 hours	0.5 ppm

*Modified from U.S. Environmental Protection Agency (EPA). "National Ambient Air Quality Standards (NAAQS)." 2009. <http://epa.gov/air/criteria.html> (25 November 2009).

EPA is in the process of revising the ozone standard. The old standard of 0.08 ppm over an 8-hour averaging time is being replaced with a new standard of 0.075 ppm over an 8-hour averaging time (EPA, 2009). The old standard and its implementation rules are currently enforced and will remain in place while EPA transitions from the old to the new standard.

EPA allows states to develop standards that are stricter than or supplement NAAQS. Tennessee has adopted a supplemental standard of 50 µg/m^3 [1.3 × 10^{-6} oz/yd^3] PM_{10} averaged over one year. In addition, TDEC monitors gaseous fluorides with regulatory thresholds expressed as hydrogen fluoride concentrations over various time intervals [1.2 parts per billion (ppb) over 30 days, 1.6 ppb over 7 days, 2.9 ppb over 24 hours, and 3.7 ppb over 12 hours (TDEC, 2006)].

Compliance with the NAAQS is determined individually for each pollutant, and an area is classified as "in attainment" when concentration levels are below NAAQS thresholds. Regions for compliance may be defined as cities, counties, or air quality control regions. An air quality control region is a federally designated area for air quality management purposes. The NFS site is located in Unicoi County, which is part of the Eastern Tennessee–Southwestern Virginia Interstate Air Quality Control Region. This region contains 27 counties in Tennessee and 13 counties in Virginia, as shown in Figure 3-3. EPA often reports NAAQS attainment status at the county or city level rather than the air quality control region as a whole. The pollutant concentration levels in Unicoi County and the three bordering counties of Carter, Washington, and Greene are in attainment for all NAAQS pollutants (see cross-hatching in Figure 3-3).

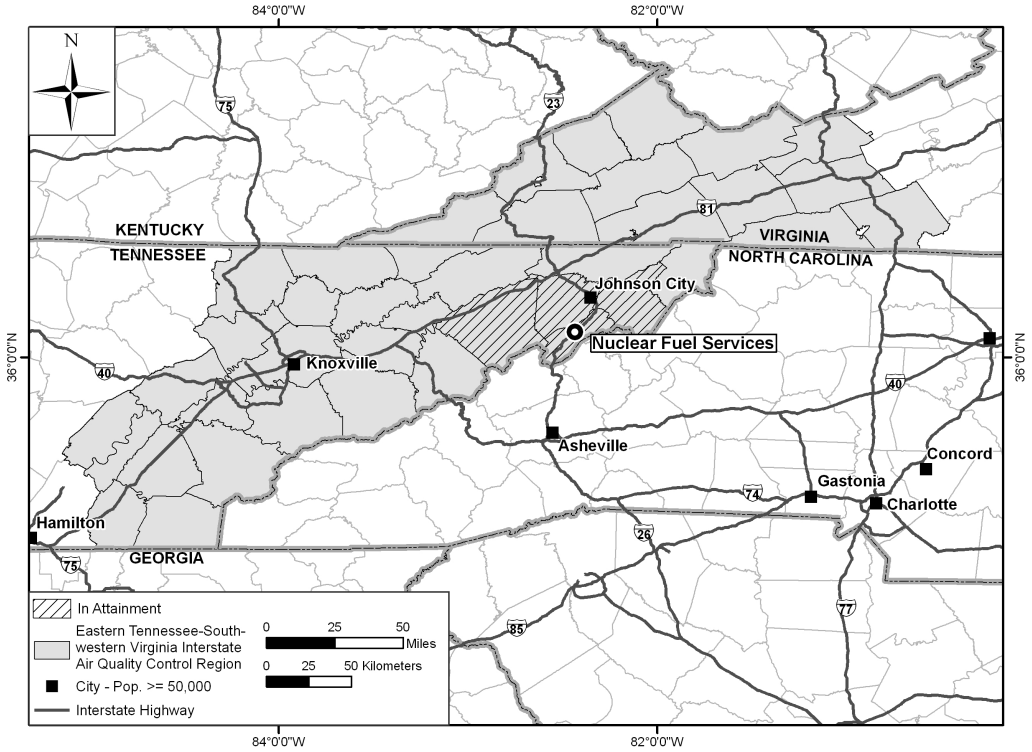

Figure 3-3. Map of the Eastern Tennessee–Southwestern Virginia Interstate Air Quality Control Region

Eight counties around Knoxville within the Eastern Tennessee–Southwestern Virginia Interstate Air Quality Control Region are not in attainment for either the 8-hour ozone and/or the $PM_{2.5}$ particulate matter (EPA, 2010). However, these eight counties are located about 76 km [47 mi] or more from the NFS site and Knoxville is around 129 km [80 mi] from the NFS site. Again, Unicoi and the surrounding counties are in NAAQS compliance. Table 3-10 contains air pollutant emissions from the EPA National Emission Inventory for Unicoi and nearby counties within the Eastern Tennessee–Southwestern Virginia Interstate Air Quality Control Region. The National Emission Inventory is a composite of emission estimates generated from state and local agencies, industry, and the EPA.

Table 3-10. Annual Air Pollutant Emissions (Mass)* for Unicoi and Select Nearby Counties

County	Unicoi	Carter	Washington	Greene	Sullivan
Approximate Distance to Erwin (km)	Not applicable	15.3 km [9.51 mi]	1.9 km [1.2 mi]	16.9 km [10.5 mi]	28.0 km [17.4 mi]
Carbon Monoxide†	2.48 MT [2.73 T]	7.53 MT [8.30 T]	311 MT [342 T]	35.9 MT [39.6 T]	8,087 MT [8,914 T]
Nitrogen Oxides†	11.8 MT [13.0 T]	132 MT [145 T]	161 MT [177 T]	24.5 MT [27.0 T]	16,782 MT [18,499 T]
Particulate Matter (PM_{10}) †	23.9 MT [26.3 T]	152 MT [167 T]	355 MT [391 T]	279 MT [307 T]	3,246 MT [3,578 T]
Particulate Matter ($PM_{2.5}$) †	16.2 MT [17.9 T]	81.0 MT [89.3 T]	268 MT [295 T]	252 MT [278 T]	2,726 MT [3,005 T]
Sulfur Dioxide†	7.14 MT [7.87 T]	14.0 MT [15.4 T]	299 MT [330 T]	20.9 MT [23.0 T]	29,519 MT [32,539 T]
Volatile Organic Compounds†	151 MT [166 T]	336 MT [370 T]	808 MT [891 T]	1,212 MT [1,336 T]	10,732 MT [11,830 T]
Hydrogen Fluoride‡	<0.01 MT [<0.01 T]	<0.01 MT [<0.01 T]	6.37 MT [7.02 T]	<0.01 MT [<0.01 T]	175.7 MT [193.7 T]

* Metric tons abbreviated as MT, while short tons abbreviated as T.
†Modified from U.S. Environmental Protection Agency (EPA). "Emissions by Category Report—Criteria Air Pollutants for 2001." 2008. <http://www.epa.gov/air/data/emcatrep.html?st~TN~Tennessee> (10 December 2009).
‡Modified from EPA. "County Emissions Report—Hazardous Air Pollutants for 2002." 2008. <http://www.epa.gov/air/data/ntisumm.html?st~TN~Tennessee> (10 December 2009).

Prevention of Significant Deterioration (PSD) requirements as promulgated by the EPA in 40 CFR 52.21 identify maximum allowable increases in concentration for particulate matter, sulfur dioxide, and nitrogen dioxide for areas designated as in attainment. Different increment levels are identified for different PSD classes. Class I areas are high value locations and have the most stringent standards. The Great Smoky Mountains National Park is the closest PSD Class I area located about 76 km [47 mi] southwest of NFS. Since EPA promulgated the PSD regulations in 1977, no PSD permits have been required for any emission source at NFS.

Burning fossil fuels and other agricultural and industrial processes produce greenhouse gases. These gases can trap heat in the atmosphere. Examples of greenhouse gases include carbon dioxide, methane, nitrous oxide, and certain fluorinated gases such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. These gases vary in their ability to trap heat.

Greenhouse gas emission levels can be expressed as CO_2e, which is a single term that accounts for the varying heat-trapping capacity of different gases. In 2005, the World Resources Institute estimated that Tennessee emitted 145.6 million metric tons [160.5 million short tons] of CO_2e, which represents 2.1 percent of the total U.S. greenhouse gas emissions (World Resources Institute, 2009).

3.5 Water Resources

3.5.1 Surface Water Hydrology

Features and Flow Characteristics

The major surface waters at and near the NFS facility include Banner Spring Branch, North Indian Creek, Martin Creek, and the Nolichucky River. Two of these, Banner Spring Branch and Martin Creek, are onsite surface water features. The channel of Banner Spring Branch is man-made, originates onsite, and flows through the NFS site. In 2003, it was enclosed in an underground pipe until it was within 9 m [30 ft] of Martin Creek to prevent contamination from storm water runoffs (NFS, 2009b, 2010a, RAI Response 4).

The average flow rate in Banner Spring Branch is 0.015 m^3/s [238 gal/min] (NFS, 2009b). Banner Spring Branch drains into Martin Creek at the northern boundary of the facility. Martin Creek flows westerly, parallel to the northern boundary of the facility, with an average flow rate of 0.19 m^3/s [3,012 gal/min] (NFS, 2009b). Martin Creek drains into North Indian Creek offsite, and North Indian Creek empties into the Nolichucky River. The Nolichucky River flows westerly outside and along the western side of the NFS site with an average flow rate of 38.5 m^3/s [610,237 gal/min] (NFS, 2009b). This average flow rate is nearly half of the mean discharge rate of the Nolichucky River [69 m^3/s (1,093,672 gal/min)], based on 88 years of discharge data, as measured at the U.S. Geological Survey (USGS) Embreevile, Tennessee gauge station (USGS, 2010a). This gauge station is located about 13 km [8 mi] downstream of the NFS facility.

The NFS site appears within the 100-year floodplain of the Nolichucky River and Martin Creek on the 2008 Flood Insurance Map put out by the U.S. Federal Emergency Management Administration (US FEMA, 2008). NFS has conducted past site development activities (e.g., enlarging a culvert through which Martin Creek passes, rerouting and rechanneling Martin Creek) that it believes has sufficiently altered the topography so that the site would be protected from a 100-year flood (NFS, 2009b).

Quality and Use

TDEC has classified surface waters at and near the facility based on water quality, designated uses, and existing aquatic biota. According to this classification, Banner Spring Branch, Martin Creek, and the Nolichucky River are suitable for fish and aquatic life, livestock watering, wildlife, irrigation, and recreation. The Nolichucky River is also suitable for industrial use and domestic water supply. The State of Tennessee Wildlife Resources Agency Erwin State Trout Hatchery, which is a coldwater trout hatching/rearing station (Tennessee Wildlife Resources Agency, 2009), is located with the Town of Erwin limits approximately 183 m [600 ft] upstream of the NFS site (ATSDR, 2007). The city of Jonesborough, located about 13 km [8 mi] downstream of the NFS outfall point, uses the Nolichucky River as a municipal water supply (NFS, 2009b). The Town of Erwin's public water is supplied from groundwater pumped from one spring and three

wells (Erwin Utilities, 2009), with the closest of these sources, the Railroad Well, located approximately 0.8 km (0.5 mi) from the NFS site (NRC, 1999).

Wetlands

Two wetlands, identified as Wetland A and Wetland B respectively, are located on the north side of the NFS site. Wetland A, with an area of 688 m^2 [0.17 ac], is fed by groundwater, while Wetland B, with an area of 728 m^2 [0.18 ac], is fed by wet-weather springs and groundwater. In January 2010, NFS submitted an application to the U.S. Army Corps of Engineers (USACE) for a permit to excavate and fill the two wetlands as part of ongoing onsite remediation activities. The USACE regulates the discharge of dredge or fill material into the waters of the United States in accordance with Section 404 of the Clean Water Act. In March 2010, the USACE authorized the NFS request to fill the wetlands under the existing Nationwide Permit 38 (March 12, 2007, 72 FR 11092) provided that NFS mitigates for the 0.14 ha [0.35 acres] of permanent wetland impacts by purchasing 0.28 ha [0.70 acres] (a 2:1 ratio) of available credits at the Shady Valley Wetland Mitigation Bank (NFS, 2010a, RAI Response 10).

3.5.2 Groundwater Hydrogeology

Geologic Setting

The NFS site is located in northeastern Tennessee in the Valley and Ridge province (NRC, 2002) (Figure 3-4). The site lies in one of a series of valleys in an alternating sequence of northeast-trending valleys and ridges produced by faulting and folding. The dominant rock type is sedimentary with alternating sequences of limestone, dolomite, shale, and sandstone.

Moving from southeast of the NFS site, across the site, and then to the northwest away from the site, three geologic formations are encountered: the Shady Dolomite, the Rome Formation, and the Honaker Dolomite (shown schematically in Figure 3-5). Figure 3-6 provides a cross section to show these formations in relation to the NFS site and other surface features.

The Shady Dolomite consists of alternating layers of light-gray dolomite, thinly bedded limestone, shaly gray limestone, and calcareous gray shale (USGS, 2010a). The karst terrain of the late lower Cambrian carbonates is found in the Shady Dolomite Formation (Benfield, 2008). Water follows complicated paths through the Shady Dolomite and serves as recharge to the Rome Formation.

The bedrock beneath the NFS site is a section of the Rome Formation, composed of sandstone, siltstone, shale, dolomite, and limestone, with silty to sandy shale being the dominant rock type (NRC, 1999). The lower portion of the Rome Formation, which is found closer to the Nolichucky River, is made up of thinly bedded sandstone and sandy shale, while the upper portion of the Formation nearer to the Shady Dolomite consists almost entirely of shales. The Rome Formation dips steeply for perhaps many hundreds of feet in depth below the NFS site (NFS, 2010a, RAI Response 9, Enclosure E, Attachment 2) and at shallow depths, is fractured and weathered. Deep bedrock that underlies shallow bedrock predominantly consists of shale with dolomite, limestone, and mudstone.

At and around the NFS site, the bedrock is overlain by unconsolidated alluvial material consisting of clay, silt, sand, gravel, and cobbles ranging from less than 0.3 m [1 ft] to 6.4 m [21 ft] in thickness (NRC, 1999). The alluvial deposits are thickest near Martin Creek on the

north and at the-extreme southern end of the facility (NFS, 2010a, RAI Response 9, Enclosure E, Attachment 1).

The Honaker Formation is dark-gray, medium-bedded dolomite with minor dark limestone beds, and it is locally cherty (USGS, 2010).

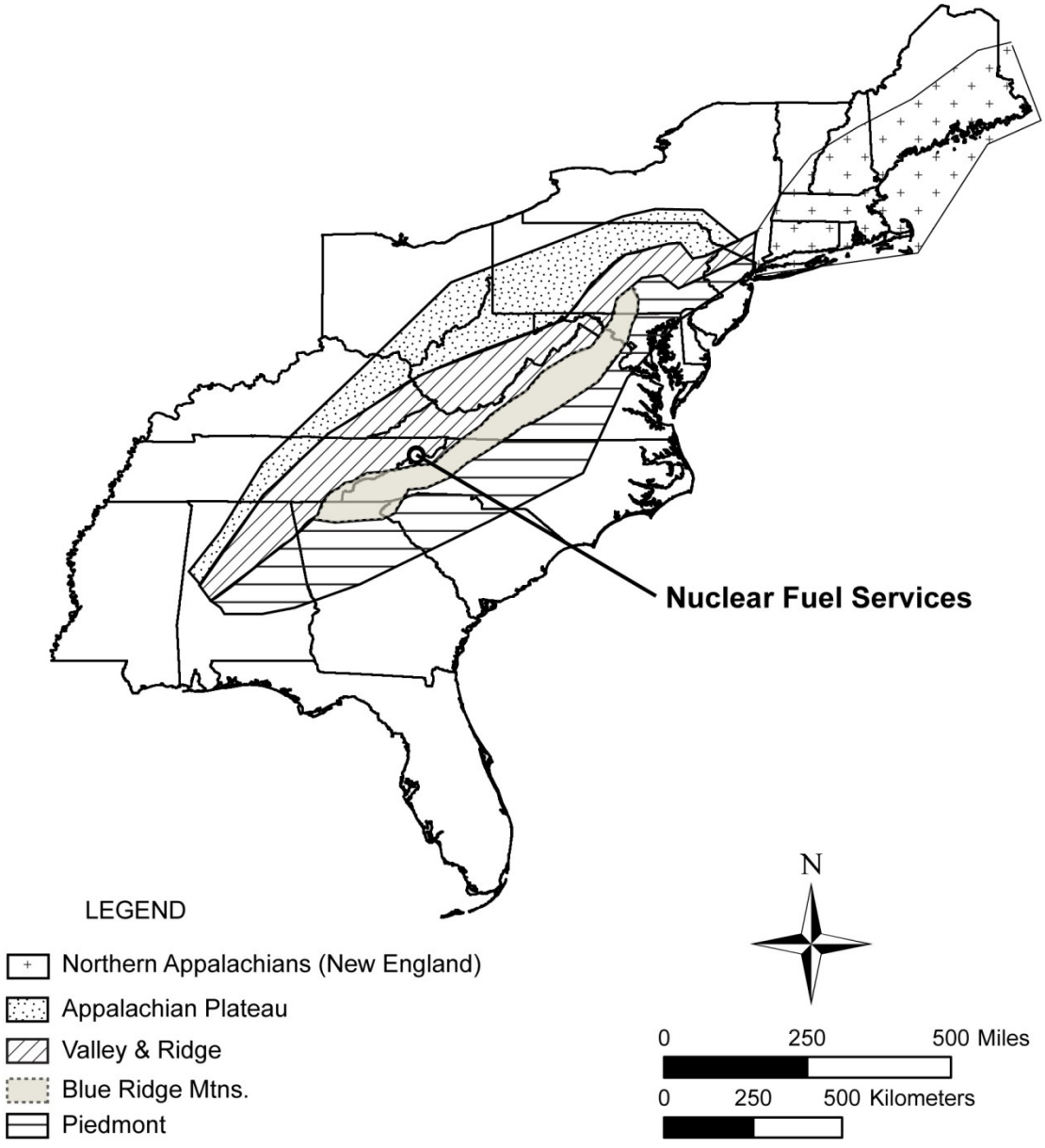

Figure 3-4. Map of the Appalachian Mountain Region (USGS, 2010a)

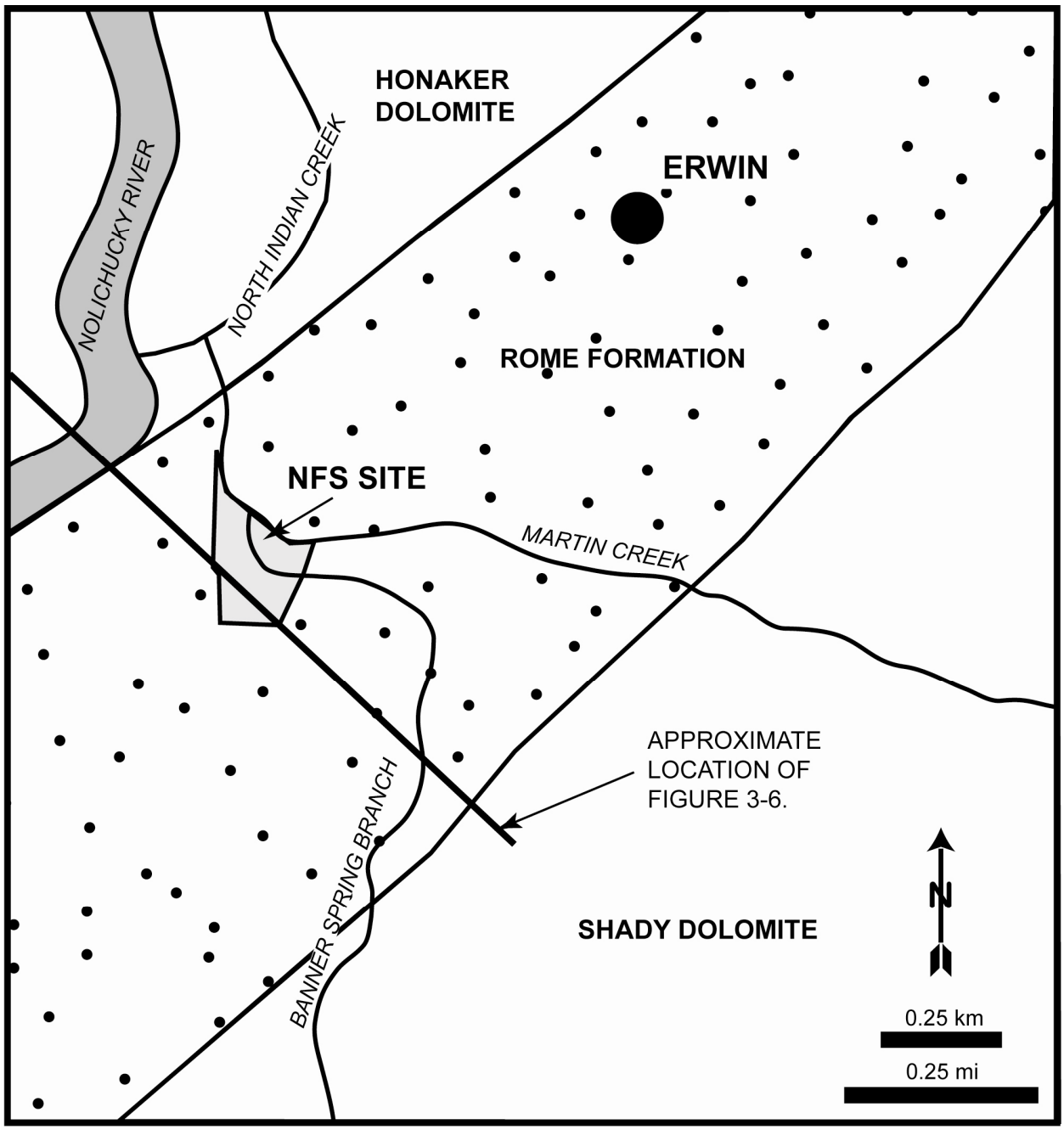

Figure 3-5. Geology of the Region around the NFS Site

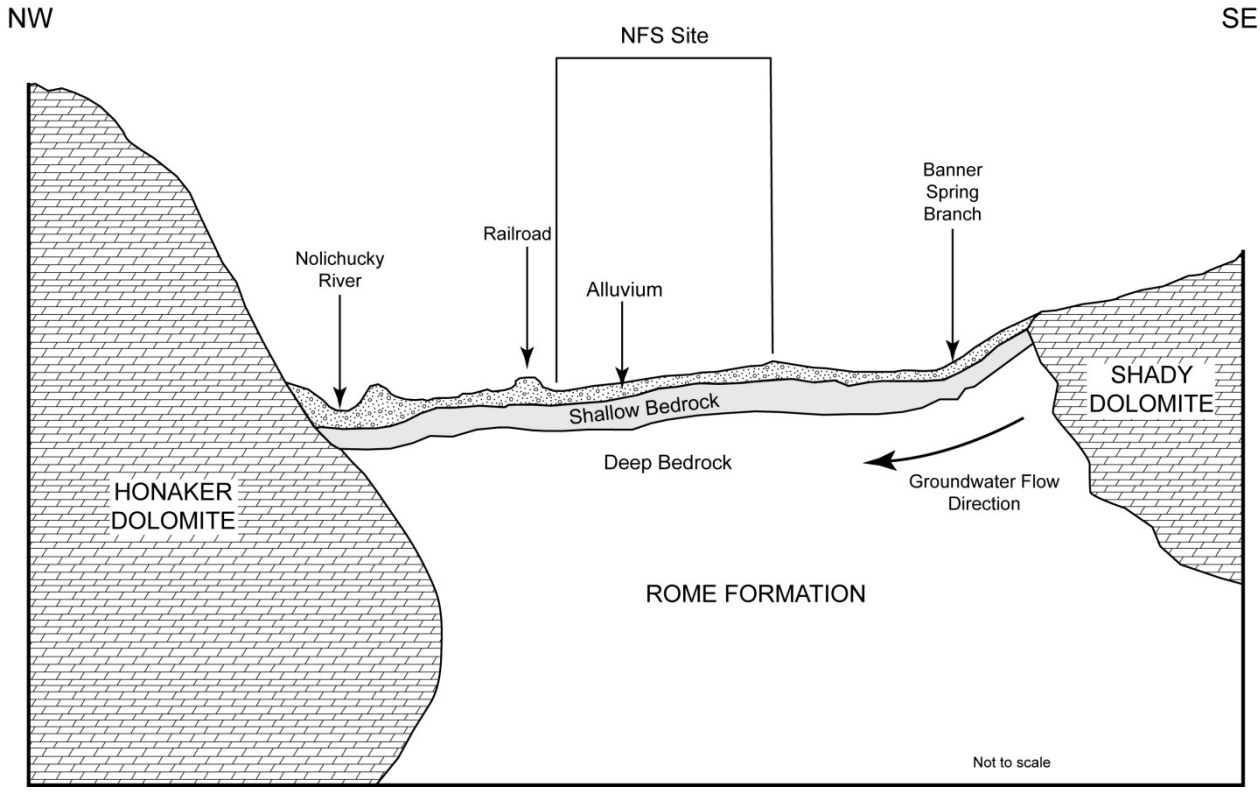

Figure 3-6. Geological Cross Section - Beneath the NFS Site (Not to Scale)

Flow Characteristics

Groundwater originating in the Shady Dolomite flows northeast through the NFS site before entering the Nolichucky River (NFS, 2010a, RAI Response 7, Enclosure C, Attachment 1). Beneath the NFS site, groundwater flow in the alluvium and in the shallow bedrock is predominantly north/northwest toward the river. Relatively sparse data from the deep bedrock beneath the site indicate a more westerly groundwater flow than that in the shallower bedrock (NFS, 2010a, RAI Response 9, Enclosure E, Attachment 2).

There is no evidence for a laterally continuous and competent confining layer (i.e., an aquitard) between the alluvium and shallow bedrock, and therefore, both the alluvium and the shallow bedrock contain groundwater under unconfined conditions (NFS, 2010a, RAI Response 7, Enclosure C, Attachment 4). NFS identified two faults and five fractured zones beneath the NFS site and linked them to large increases in groundwater levels and production rates during pump tests (NFS, 2010a, RAI 9, Enclosure E, Attachment 1). NFS reported some evidence for limestone and dolomite dissolution features (secondary porosity) in the northern parts of the site. However, NFS indicated that flow in the bedrock obeys porous medium flow (similar to flow through a sponge) rather than flow through fractures, which is a much faster and channelized flow (similar to flow through a pipe) (NFS, 2010a, RAI Response 9, Enclosure E, Attachment 2).

In general, hydraulic conductivity (i.e., the ease with which water can move through pore spaces or fractures) decreases with depth at the NFS site. In the alluvium, coarse-grained (sand to boulder) layers are the most conductive zones. NFS estimated the average groundwater velocity in the alluvium to be 0.44 m/day [1.43 ft/day] based on an average hydraulic conductivity of 6.9 m/day [22.6 ft/day], an average hydraulic gradient of 0.19 m/m [0.19 ft/ft], and a porosity of 0.3. The shale, weathered dolomite, and siltstone layers of the Rome Formation are the moderate- to low-conductive zones, and competent bedrock generally displays low conductivity. NFS estimated the average groundwater velocity in the shallow bedrock to be 0.27 m/day [0.89 ft/day], based on an average hydraulic conductivity of 2.4 m/day [7.89 ft/day], an average hydraulic gradient of 0.17 m/m [0.17 ft/ft], and a porosity of 0.15. NFS estimated average groundwater velocity in the deep bedrock to be 0.09 m/day [0.28 ft/day], based on an average hydraulic conductivity of 1.29 m/day [4.23 ft/day], an average hydraulic gradient of 0.01 m/m [0.01 ft/ft], and a porosity of 0.15 (NFS, 2010a, RAI Response 9, Enclosure E, Attachment 2). Although an upward hydraulic gradient from the shallow bedrock to the alluvium in the northeastern portion of the site may limit potential contamination reaching larger depths, there is also evidence of downward hydraulic gradients at the NFS site (e.g., near well clusters 100 and 107) (NFS, 2010a, RAI Response 9, Enclosure E, Attachment 2).

Recharge to alluvium and bedrock is from direct precipitation, local upward flow from deeper bedrock (NFS, 2010a, RAI Response 7, Enclosure C, Attachment 4), and subsurface movement of groundwater from beneath the adjacent hill slopes in the Shady Dolomite defined previously. Discharges from these aquifers occur as vertical water exchange between the aquifers and seepage areas, seepage at the ground surface, or through the beds of gaining streams (streams fed by groundwater) (NFS, 2010a, RAI 9, Enclosure E, Attachment 1). NFS identified five major water supplies through wells and springs within 8 km [5 mi] of the facility and all these water supplies are associated with faulted or fractured rocks or karstic features (cavities formed by reactions between carbonate rocks and groundwater) (NFS, 2010a, RAI 9, Enclosure E, Attachment 1).

Monitoring and Quality

As described in Section 2.4, NFS developed an active groundwater monitoring well network across the site (monitoring wells are completed both in the alluvium and bedrock aquifers). The majority of these wells are routinely sampled for various chemical parameters on an annual, semiannual, quarterly, or monthly basis (NFS, 2009b). NFS shares the summary and its monitoring and remediation progress with TDEC Hazardous Waste Management at the semiannual Facility Action Plan workshop; this information is captured in a Facility Action Plan document (NFS, 2009d, 2010b) that is required under the Resource Conservation and Recovery Act (RCRA) corrective action process for the site.

The predominant radiological contaminant in groundwater beneath the site is uranium. Non-radiological, organic hazardous contaminants beneath the site include chlorinated solvents (e.g., tetrachloroethylene, trichloroethylene), barium, cadmium, chromium, and lead (NFS 2010a, RAI Response 7, Enclosure C, Attachment 4). For groundwater, NFS has established and described 24 Solid Waste Management Units (SWMU) and six Areas of Concern (AOC) as part of a Facility Action Plan process TDEC requires (NFS, 2010b). As shown in Table 3-11, 11 SWMU and 1 AOC require no further action pending TDEC and EPA approval. Seven SWMU and one AOC require interim measures (further corrective measures) (NFS, 2010a, RAI Response to 7, Enclosure C, Attachment 4). Six SWMU and four AOC require institutional controls, which often include physical covering (using gravel or cement) of the particular site accompanied by posting proper signs.

Table 3-11. Solid Waste Management Units and Areas of Concern at the NFS Site, Including Current Status of Remediation Activities*		
SWMU/AOC	**Description**	**Status**
SWMU 1	Impoundments 1, 2, and 3	Interim measures
SWMU 2	Impoundment 4	Interim measures
SWMU 3	Building 110 complex underground storage tank	Interim measures
SWMU 4	Yard incinerator	Interim measures
SWMU 6	Abandoned Banner Spring Branch stream channel	Interim measures
SWMU 7	Soil stock pile	Interim measures
SWMU 8	CSX soil excavation site	No further action
SWMU 9	Radiological burial ground trenches	Interim measures
SWMU 10	Demolition landfill	No further action
SWMU 11	CSX burial trenches	No further action
SWMU 12	Permitted hazardous waste management area	No further action
SWMU 13	Building 111 bulk chemical storage area	Institutional controls
SWMU 14	Light nonaqueous phase liquid	No further action
SWMU 15	Waste water Treatment Facility	Institutional controls
SWMU 16	Radiological incinerator	Institutional controls
SWMU 17	Scrap recovery incinerator	No further action
SWMU 18	Building 105 underground storage tank	No further action
SWMU 19	Building 100 underground storage tank	No further action
SWMU 20	Building 130 scale pit	Institutional controls
SWMU 21	30,000 gallon diesel above ground storage tank	Institutional controls
SWMU 22	Building 304 hazardous waste unit	No further action
SWMU 23	Building 304 hazardous waste unit	No further action
SWMU 24	Building 304 hazardous waste unit	No further action
SWMU 25	Underground pipe on the west side of Building 111	Institutional controls
AOC 1	Plant scrubbers	No further action
AOC 2	Building 111 1,000-gallon tank	Institutional controls
AOC 3	Building 130 cooling tower	Institutional controls
AOC 4	Storm drainage system	Institutional controls
AOC 5	Banner Spring Branch channel	Interim measures
AOC 6	Building 220 mercury contaminated soil	Institutional controls
AOC Groundwater	Sitewide groundwater	Groundwater remediation under AOC groundwater

*NFS. "Response to the Request for Additional Information Regarding the Environmental Assessment for Nuclear Fuel Services, Inc. Materials License SNM–124 Renewal." Docket No. 70-143. ML101590160. Erwin, Tennessee: NFS. 2010.

One uranium plume and one chlorinated solvent plume have been identified at the NFS site that contain concentrations of contaminants exceeding EPA standards for their respective contaminants (NFS, 2010a, RAI Response 7). Both plumes originated from three unlined impoundments (SWMU 1) and the maintenance shop area (SWMU 20) located in the northern portion of the NFS site (NFS, 2010a, RAI Response 7), and both extend toward the Nolichucky River. The uranium plume is confined in the alluvium and has remained onsite to date (NFS, 2010a, RAI Response 7, Attachment 2). The chlorinated solvent plume, which includes

trichloroethylene, perchloroethylene, and their degradation products, extends vertically into the bedrock to a depth of 12 m [40 ft] below the surface and horizontally offsite (NFS, 2010a, RAI Response 7, Attachment 1). Waste removal from the impoundments at SWMU 1 was completed in May 1994, and SWMU 1 continues to be under remediation. Institutional controls were implemented at SWMU 20, and soil removal and effectiveness sampling are planned as part of the 2010 Facility Action Plan (NFS, 2010b).

The main purpose of remediation is to prevent further migration of both plumes and to enhance degradation of the chlorinated solvents (NFS, 2010a, RAI Response 7, Attachment 1). *In-situ* enhanced anaerobic reductive dechlorination has been used for the chlorinated solvent plume and *in-situ* reductive precipitation using ferrous sulfate has been used for the uranium plume. As of 2009, ongoing remediation efforts at SWMU 20 have resulted in a continuous decrease in uranium concentration, a 76 percent reduction in the size of the uranium plume, and a 91-percent reduction in the size of the onsite chlorinated solvent plume (NFS, 2010a, RAI Response 7, Attachment 2).

Other remediation efforts are underway. SWMU 2 (Impoundment 4), which was used for waste storage and disposal, was closed and put under remediation in December 1996 (NFS, 2010a, RAI Response 7, Attachment 4). Soil removal at SWMU 9 (radiological burial ground trenches) was completed and is under remediation. Further soil removal and effectiveness sampling at a number of SWMUs are planned as part of the 2010 Facility Action Plan (NFS, 2010b). These actions were and are being taken to remove the sources of future groundwater contamination.

3.6 Seismicity

Regionally, the area is dominated by four major fault systems oriented in a northeast direction (Figure 3-7) (NRC, 1999). The NFS site is located in the Appalachian Tectonic Belt, which is an area of moderate historic and recent earthquake activity (Figure 3-8) (NRC, 2002). Faults and fractures present at the site as demonstrated by the drilling show no evidence of recent fault displacement associated with capable faults (NRC, 1999). A peak ground acceleration of 60 cm/s^2 [0.06 G] with a return period of 1,000 years was calculated for the site (Moore, 2001). A slightly higher peak ground acceleration of 80 cm/s^2 [0.08 G] with a return period of 1,000 years is indicated in Petersen, et al. (2008).

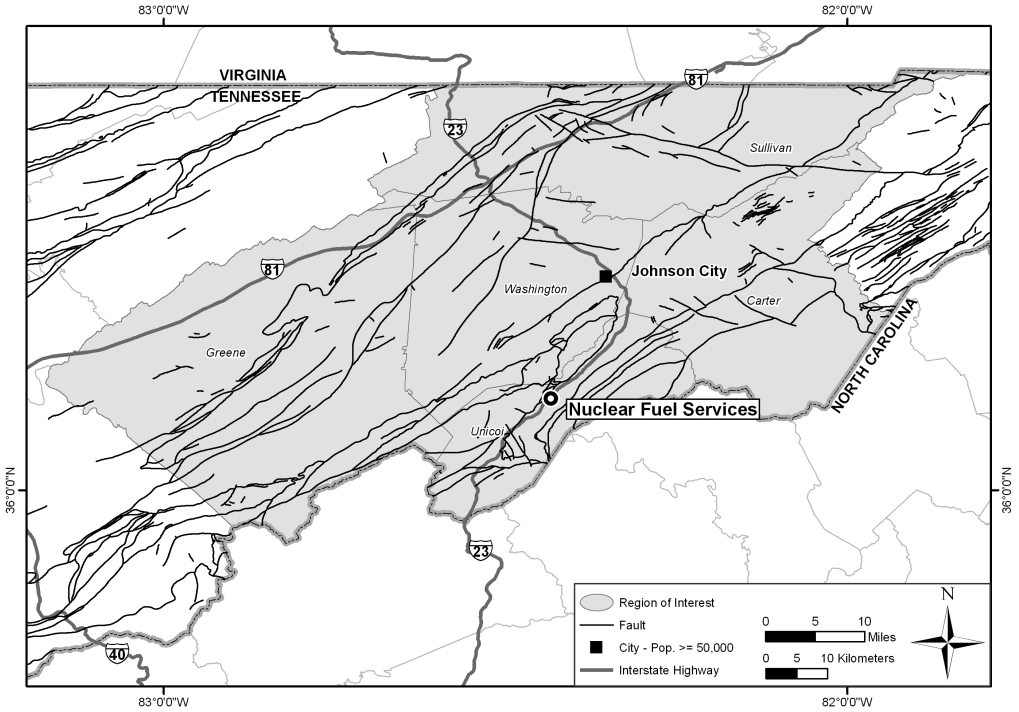

Figure 3-7. Regional Fault Map Showing Northeast Trending Faults (USGS, 2010b).

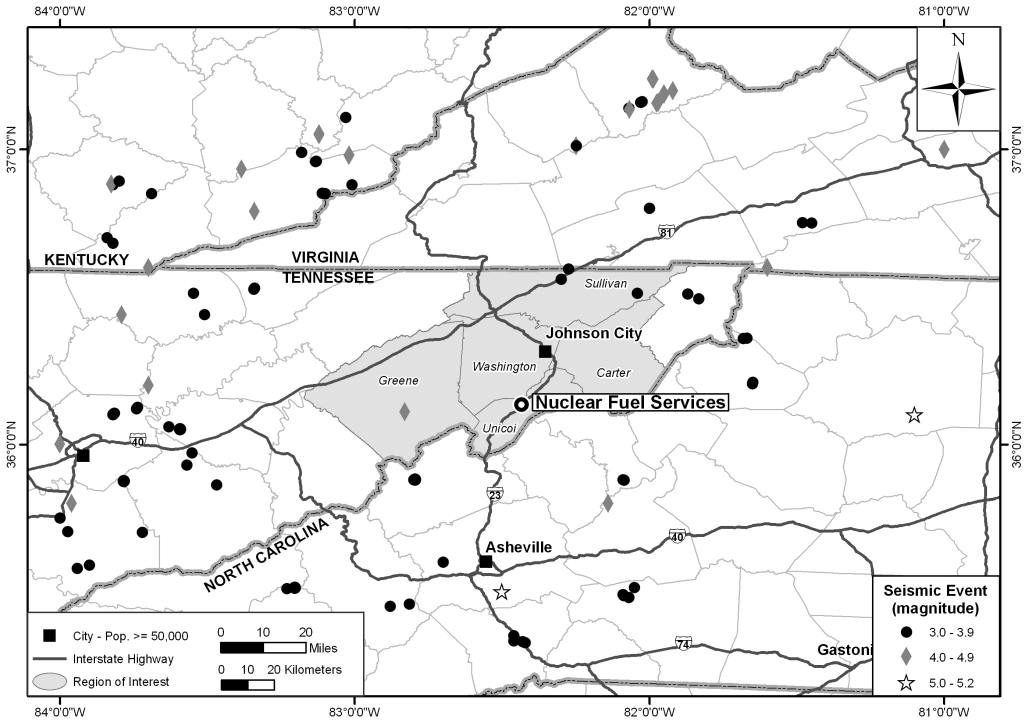

Figure 3-8. Recent and Historic Seismic Activity in the Vicinity of the NFS Site.
(Data from USGS (2010c); Northern California Earthquake Data Center and Worldwide Earthquake Catalog, Advanced National Seismic System (2010); Center for Earthquake Research and Information (2010), University of Memphis)

3.7 Ecology

3.7.1 Terrestrial and Aquatic

The Town of Erwin is a municipal populated area surrounded by the North Cherokee National Forest managed by the U.S. Forest Service (U.S. Forest Service, 2004). This area is identified as the Appalachian/Blue Ridge Forests ecoregion (World Wildlife Fund, 2008). Previous EAs describe the species and habitats found in the valley where the NFS site is located (NRC, 1999). Appalachian oak forests, northern hardwood forests, Southeastern spruce–fir forests, shrublands, grasslands, heath balds, hemlock forests, cove hardwoods, and oak–pine communities occur in the region (Arnwine, et al., 2000). In the valley, human activities since the 1770s, including agriculture, repeated timber harvests, and industrial and residential development, have altered vegetation, resulting in patches of regrowth (Town of Erwin, 2010). The most significant change in the regions' valleys from presettlement conditions has been the decrease in forest cover and the increase in open areas, such as pasture and croplands (World Wildlife Fund, 2008).

The NFS site, which is mostly developed for NRC-licensed activities, is located in an industrial zone of Erwin. Table 3-1 shows that 20 percent (5.6 ha [14 acres]) of undeveloped land at the NFS site is open fields, woods, brush, and shrub swamp along the riparian areas of Martin Creek. Although no site-specific vegetation surveys have been conducted for the NFS site and over the past 10 years, a significant amount of vegetation on the site has been removed due to decommissioning activities (NFS, 2010a). Vegetation, birds, mammals, and aquatic life that are known to be found in the area around the NFS site are listed in the Appendix.

State of Tennessee water quality standards specify which uses individual waters should support (e.g., recreation, aquatic life use support, or drinking water supply). Banner Spring Branch and Martin Creek are designated for use by fish and aquatic life, livestock watering and wildlife, irrigation, and recreation (EPA, 2010; NFS, 2009b). Banner Spring Branch is entirely contained inside an underground enclosed pipe and no longer offers habitat for wildlife (NRC, 2002).

3.7.2 Threatened and Endangered Species

The Tennessee Natural Heritage Program (2009) in the TDEC, Division of Natural Areas maintains a database of rare animal and plant species that is shared by partners at The Nature Conservancy, Tennessee Wildlife Resources Agency (2009), U.S. Fish and Wildlife Service (FWS), and TVA. The database lists all state and federally threatened and endangered species, as well as state species of special concern and those deemed in need of management. According to the Tennessee Natural Heritage Program (2009), no federally listed species are known to occur in the area depicted on the Erwin 7.5-minute USGS quadrangle map. The area represented on each quadrangle map varies with latitude and ranges from 164 km^2 [64 mi^2] at latitude 30 degrees north to 126 km^2 [49 mi^2] at latitude 49 degrees north; NFS is located near 36 degrees north, so the area is approximately 149 km^2 [58 mi^2]. In the area depicted on the Erwin 7.5-minute USGS quadrangle map (TDEC, 2009), seven plants and two birds are listed as state threatened or endangered, and eight plants and six vertebrate animals are listed as deemed in need of management or of special concern.

NFS is located approximately 0.8 km [0.5 mi] north of the area covered by the Chestoa 7.5-minute USGS quadrangle map. In addition to those species identified as occurring within the bounds of the Erwin 7.5-minute USGS quadrangle map, two federally listed endangered

species and one federally threatened species are known to occur in the area depicted on the Chestoa 7.5-minute USGS quadrangle map and elsewhere in Unicoi County: (i) the Appalachian elktoe (*Alasmidonta raveneliana),* a mussel found in the upper Tennessee River watershed, which includes the Nolichucky River; (ii) the Virginia spiraea *(Spiraea virginiana),* a shrub found on banks of rocky streams or moist bottomlands within high gradient sections of second and third order streams such as occur in the region around NFS*;* and (iii) the Gray Myotis *(Myotis grisescens*), a small bat that resides in caves year round (TDEC, 2009). These species are not listed as being present in the area depicted on the Erwin 7.5-minute USGS quadrangle map, and the associated habitats do not occur on the NFS site. Also, nine plants listed as state threatened or endangered, three plants of special concern, and three vertebrate animals listed as deemed in need of management are known to occur in the area depicted on the Chestoa 7.5-minute USGS quadrangle map (TDEC, 2009).

NFS has not reported any federally listed threatened or endangered species onsite. NRC staff contacted FWS in October 2009 regarding threatened or endangered species in the vicinity of the NFS site. In December 2009, the FWS replied and stated that, according to available records, no federally listed or proposed endangered or threatened species occur within the impact area of the project (FWS, 2009). Rare, threatened, and endangered species known to occur in the Erwin 7.5-minute USGS quadrangle map area are shown in the Appendix.

3.8 Noise

Major noise sources at NFS include various industrial machines and equipment. Examples include cooling systems, transformers, engines, pumps, boilers, steam vents, paging systems, alarms, construction and materials-handling equipment, and vehicles (NFS, 2009b). The primary source of noise at the site boundary is vehicular traffic, with other sources occasionally producing noise above background levels. Although the Code of Ordinances for the Town of Erwin recognizes “offenses against the peace and quiet,” Erwin does not have a specific environmental noise standard that is applicable to NFS. Further, the Code of Ordinances does not reference a decibel level that defines “excessive.” NFS stated that plantwide alarms needed for employee notification would provide the greatest potential for offsite noise exposure, with the take-cover alarm being the loudest. Sound level surveys at various locations on the outside perimeter of the site during alarm testing did not indicate any levels above Occupational Safety and Health Administration limits (NFS, 2010a, Response 17, Enclosure L). NFS further stated it has not received complaints from the Town of Erwin regarding excessive noise.

3.9 Historic and Cultural Resources

The National Register of Historic Places (NRHP) lists three historical sites within Unicoi County (U.S. Department of the Interior National Park Service, 2009). The Clinchfield Depot is in the Town of Erwin, about 2.7 and 2.9 km [1.7 and 1.8 mi], from the NFS site, while the Tilson Farm site in Flag Pond and the Clarksville Iron Furnace on Tennessee State Highway 107 in the Cherokee National Forest both are located approximately 16 km [10 mi] from the site. There are no NRHP properties or National Historic Landmarks[2] located on the NFS site (U.S. National Park Service, 2009). According to the Tennessee State Historical Preservation Office, there are no historic or cultural sites on the NFS site (Tennessee Historical Commission, 2009).

[2] NFS was designated a Nuclear Historic Landmark by the American Nuclear Society in 2009 (NFS, 2009e).

3.10 Scenic and Visual Resources

The site, known as the "Valley Beautiful," is situated in a valley in Unicoi County between the Bald Mountains to the southwest and the Unaka Range to the east, both of which are part of the Appalachian Mountains (Town of Unicoi, 2010). Martin Creek runs along the northern site boundary, and Banner Spring Branch is located in the central portion of the site, although it is entirely contained inside an underground enclosed pipe on the NFS site. The Martin Creek corridor is vegetated with grass, shrubs, and trees. As detailed in Section 3.1, the area surrounding the NFS site consists of a mix of residential, commercial, industrial, and agricultural activities.

The major landscape features that are located in the vicinity of the NFS site are the Nolichucky River and the forested hillsides that surround the valley where the NFS site is located. The NFS site is approximately 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 (NFS, 2002) and, therefore, cannot be seen from the river.

At its nearest point, the Appalachian Trail crosses the Nolichucky River at Chestoa Pike southwest of NFS approximately 2.8 km [1.7 mi]. The trail then follows the back side of peaks that block the site from view of the trail and continues along the state line ridge that divides Tennessee and North Carolina (Appalachian Trail Conservancy, 2010). At the point that the Appalachian Trail crosses the Nolichucky River, the elevation is about the same as the site elevation; thus, vegetation would preclude the site from being viewed from this location. Further up the mountain on Cliff Ridge, a person on the Appalachian Trail would be able to see the expanse of the Town of Erwin (Tennessee Eastman Hiking & Canoeing Club, 2010), but would not be able to identify the site in particular.

The Erwin Linear Trail is a paved trail that runs parallel to I-26 along North Indian Creek and the Nolichucky River (Unicoi County, 2010a). Due to the locally flat terrain, the NFS site may be partially visible from the banks of the Nolichucky River and the linear trail because an industrial park and a railroad are located between the site and the river and trail. However, bikers and walkers on trail paths located along the northwest side of the Nolichucky River that extend up on the steep hillsides to the northwest or south would be able to see the NFS site. The Unicoi Chamber of Commerce identifies several trails in the area, but does not provide a map of the trails listed (Unicoi County, 2010b). Trail descriptions do not indicate whether the trails are located in areas that offer a recognizable view of the site. No trails within visibility of NFS were identified using an online search (Trails.com, 2010).

An 13-km [8-mi] stretch of the Nolichucky River, upstream of where it flows past the NFS site, has been recognized for its scenic, recreational, and geologic values under the Nationwide Rivers Inventory (U.S. National Park Service, 2009). The stretch extends from Poplar, North Carolina, downstream to the railroad bridge at Unaka Springs, Tennessee, which is located approximately 3.3 km [2 mi] southwest of the NFS site. The NFS site is not visible from the Unaka Springs crossing due to a mountain between the two points.

NFS noted three changes have been made to the site since the 1980s that could present visual impacts: (i) decommissioning of portions of the plant site that started in the mid-1980s, (ii) construction of the AREVA NP (BLEU Complex) Facility on the southwest side of the site in August 2002, and (iii) ongoing construction of a security wall around the perimeter of the main NFS site that started in 2007 (NFS, 2009b). Security wall construction also is expected to

provide a visual barrier shielding buildings and/or other structures on the NFS site from street-level view around the adjacent blocks.

3.11 Public and Occupational Health

As described in Section 2.1, the NFS site includes a fuel fabrication facility for commercial and government clients. The primary operations at this site include the manufacture of a classified product containing HEU and the downblending of HEU to LEU. Risks to occupational health and safety include exposure to industrial hazards, hazardous materials, and radioactive materials. Industrial hazards for the NFS site are typical for similar industrial facilities and include exposure to chemicals and accidents ranging from minor cuts to industrial machinery accidents.

The Occupational Safety and Health Administration requires that NFS compile information on workplace total recordable incident rates and lost-time incident rates.[3] For comparison, the U.S. Department of Labor, Bureau of Labor Statistics (2010), reports annual incident rates for chemical facilities (North American Industry Classification System Number 3251). The incident rate is the total number of reportable accidents that occur per 200,000 hours worked and includes lost-time incidents. Lost-time incidents are those accidents that result in a worker missing one or more days because of the accident. Thus, the lost-time incident rate provides a measure of the severity of the incident. Incident rates for NFS are compared to Department of Labor statistics in Table 3-12 for the past 5 years. There have been no fatalities of NFS employees during the operating history of the NFS site (NFS, 2010a).[4]

Table 3-12. Incident Rates (Incidents Per 200,000 Worker-Hours) for 2005–2009*

Year	Occupational Safety and Health Administration Total Recordable Incident Rate*	Bureau of Labor Statistics Average Recordable Incident Rate†	Occupational Safety and Health Administration Lost Time Incident Rate*	Bureau of Labor Statistics Average Lost Time Incident Rate†
2009	3.92	NA‡	0.61	NA‡
2008	2.90	2.2	0.66	0.6
2007	3.20	2.7	0.46	0.7
2006	1.81	2.1	0.0	0.6
2005	3.58	2.4	0.43	0.7

*NFS. "Response to the Request for Additional Information Regarding the Environmental Assessment for Nuclear Fuel Services, Inc. Materials License SNM-124 Renewal." Docket No. 70-143. Erwin, Tennessee: NFS. 2010.
†U.S. Department of Labor, Bureau of Labor Statistics. "Industry Injury and Illness Data." <http://www.bls.gov/iif/oshusum.htm> (27 July 2010).
‡NA: Not Available

[3] Total recordable incidents are work-related deaths, illnesses, or injuries resulting in loss of consciousness, restriction of work or motion, transfer to another job, or required medical treatment beyond first aid. A lost-time incident is a recordable incident that results in one or more days away from work, days of restricted work activity, or both, for affected employees. Fatalities are the number of occupationally related deaths. The incident rate includes both the number of Occupational Safety and Health Administration-recordable injuries and illnesses and the total number of man-hours worked. The incident rate is used for measuring and comparing work injuries, illnesses, and accidents within and between industries.

[4] On May 19, 2004, a contract construction worker was killed in an accident while working on a new construction project within the protected area at the NFS site (NRC, 2004).

Since the last license renewal, two studies addressing public health and involving NFS have been published. In 2007, the Agency for Toxic Substances and Disease Registry (ATSDR) published a public health study on the non-radiological contaminants from NFS that evaluated the releases of volatile organic compounds to the environment surrounding NFS (ATSDR, 2007). The study concluded that the releases of these materials may have occurred in the 1950s, 1960s, and 1970s but that there was little or no monitoring of the environmental media at that time. ATSDR considered the NFS facility hazard ranking as an Indeterminate Public Health Hazard for past conditions, which means that critical information is lacking to support a judgment regarding the level of public health hazard from past exposures. Further, ATSDR ranked the NFS site as No Apparent Public Health Hazard. Finally, ATSDR concluded that any exposures are not at levels likely to cause adverse health impacts. The ATSDR study did not apply to the use of radioactive materials by NFS.

In 2008, the National Institute for Occupational Safety and Health published a site profile document to support evaluation of the total occupational radiation dose that can reasonably be associated with a worker's radiation exposure at the W.R. Grace and Company plant (now NFS). Site profile documents are not official determinations made by the National Institute for Occupational Safety and Health but are general working documents that provide historic background information and guidance to help prepare dose reconstructions at particular sites. The document provided instructions for reconstructing occupational dose received by workers at W.R. Grace and Company for the years between 1958 and 1970. However, the document does not attempt to equate the dose to the workers to any occupational health effects.

NFS operations result in the use and release of several radionuclides. Table 3-13 lists radionuclides that occur in various effluents and the effluent in which they occur. The limits in 10 CFR Part 20, Appendix B for the activity in effluents varies with the radionuclide and with the type of effluent. However, the risk to the public from these radionuclides is determined by calculating the total effective dose equivalent (TEDE) for the radionuclides and types of effluents.

Table 3-13. Radionuclides in Effluents at the NFS Site*

Radionuclide	BLEU Sewer	Sewer	Waste Water Treatment Facility	Gaseous
Na-22			X	
Tc-99	X	X	X	X
Cs-137			X	
Pb-212			X	
Ra-224			X	
Th-228	X	X	X	X
Th-230	X	X	X	X
Th-231			X	X
Th-232	X	X	X	X
U-232	X	X	X	
U-233	X	X	X	
U-234	X	X	X	X
U-235	X	X	X	X

Table 3-13. Radionuclides in Effluents at the NFS Site*				
Radionuclide	**BLEU Sewer**	**Sewer**	**Waste Water Treatment Facility**	**Gaseous**
U-236	X	X	X	
U-238	X	X	X	X
Np-237			X	
Pu-238	X	X	X	X
Pu-239	X	X	X	X
Pu-240	X	X	X	X
Pu-241			X	X
Am-241			X	X
* Ward, D.C. "Biannual Effluent Monitoring Report July Through December 2009." Letter (February 22) to Director, Office of Nuclear Material Safety & Safeguards, NRC. ML100700519. Erwin, Tennessee: Nuclear Fuel Services, Inc. 2010.				

For a U.S. resident, the average annual estimated TEDE from natural background radiation sources is 3.0 mSv [300 mrem] but varies by location and elevation (NCRP, 2009). The source of this TEDE includes cosmic radiation, radionuclides generated by interactions between the atmosphere and cosmic radiations (cosmogenic radionuclides), radiation sources in the Earth (terrestrial sources), naturally occurring radionuclides in the air and in food (inhaled and ingested), and naturally occurring radionuclides that reside in the body. Reduced radon levels in eastern Tennessee would tend to lower the natural background dose in Erwin, but the elevation would tend to raise it. In the absence of any published values for background TEDE levels in Erwin, estimating the background TEDE at 3.0 mSv [300 mrem] is warranted. In addition to dose from natural background, a U.S. resident receives an average of 0.6 mSv [60 mrem] per year from man-made radiation sources, primarily medical sources.

The TEDE combines committed doses from radioactivity inside the body and the dose equivalent from radioactivity outside the body to provide a measure of the overall detriment. Committed (internal) doses (ingestion and inhalation) of radioactive materials are generally calculated from airborne radioactive effluent measurements. For monitored workers, committed dose is based on measured airborne radioactivity concentrations or from bioassay results. Generally bioassay results are only used for evaluating incidents.

NFS estimates committed dose to the public by establishing a location for the maximally exposed individual (MEI). For gaseous effluent, the MEI is a hypothetical member of the general public that resides at the site boundary. The location of the MEI varies depending on wind direction and the relative contributions from the various stacks. The wind direction is based on 5-year average wind speed and direction frequencies. The dose to the MEI is determined using a computer code that calculates the dose from each type and quantity of radioactivity in effluent air from each of the 20 stacks at NFS. For liquid effluents, the MEI is a hypothetical member of the general public that drinks water directly from the river at the nearest drinking water intake point. The TEDE to the MEI for liquid effluent is calculated based on data for flow in the Nolichucky River in combination with data collected for all liquid effluents discharged to the river.

Table 3-14 provides the TEDE to a member of the public from all gaseous radioactive effluents for the most recent 6 years. The highest TEDE for this time period was in 2004

{1.14 × 10^{-3} mSv [0.0114 mrem]}, and the TEDE has remained substantially lower than 2004 in subsequent years. The NRC annual TEDE limit to a member of the public is 1 mSv [100 mrem]. The NRC annual occupational dose limit is 50 mSv [5 rem].

Table 3-14. Total Effective Dose Equivalent to the Maximally Exposed Individual From Gaseous Effluents*

Year	TEDE (mrem)	TEDE (mSv)
2009	0.0049	4.9×10^{-5}
2008	0.0030	3.0×10^{-5}
2007	0.0020	2.0×10^{-5}
2006	0.0044	4.4×10^{-5}
2005	0.0067	6.7×10^{-5}
2004	0.0114	1.14×10^{-4}

*Compiled from multiple reports similar to Moore, B.M. "Biannual Effluent Monitoring Report January Through June 2004." Letter (August 27) to W.D. Travers, U.S. Nuclear Regulatory Commission. Erwin, Tennessee: Nuclear Fuel Services, Inc. 2004.
Ward, D.C. "Biannual Effluent Monitoring Report July Through December 2009." Letter (February 22) to Director, Office of Nuclear Material Safety & Safeguards, NRC. ML100700519. Erwin, Tennessee: Nuclear Fuel Services, Inc. 2010.

Table 3-15 provides the TEDE to the MEI from all liquid radioactive effluents for 2004 through 2008. Data were not available for 2009. The highest TEDE from liquid effluents for this time period was in 2005 {1.1 × 10^{-3} mSv [0.011 mrem]}, and the TEDE has remained substantially lower than 2004 in other years. The TEDE for 2005 represents just over 1/100th of a percent of the limit.

Table 3-15. Total Effective Dose Equivalent to the Maximally Exposed Individual from Liquid Effluents*

Year	TEDE (mrem)	TEDE (mSv)
2008	0.004	4×10^{-5}
2007	0.004	4×10^{-5}
2006	0.004	4×10^{-5}
2005	0.011	1.1×10^{-4}
2004	0.005	5×10^{-5}

*NFS. "NFS Facts." Erwin, Tennessee: NFS. 2009. < http://www.nfsfacts.com/facts.html> (April 2010).

External radiation doses are measured using dosimeters that are issued to workers who have a potential to receive external radiation doses. Thermoluminescence dosimeters or optically stimulated luminescence dosimeters provide results for monitored individuals to determine their deep dose equivalent and shallow dose equivalent. A dosimetry service that maintains accreditation by the National Voluntary Laboratory Accreditation Program assigns doses measured using thermoluminescence dosimeters or optically stimulated luminescence dosimeters. NFS currently uses optically stimulated luminescence dosimeters to monitor workers' occupational dose equivalent and to measure direct radiation deep dose equivalent at various locations at the site boundary. The MEI for direct radiation is a member of the general public that is that is occupying a position at the fence line at all times.

Table 3-16 presents the maximum measured deep dose equivalent (DDE) at the fence line between 2005 and 2009. The fence line DDE assumes that a hypothetical person resides at the

fence line 24 hours per day and 365 days per year. Applying an occupancy factor of 0.0625 for occasional occupancy would reduce the DDE by a factor of 16 (NCRP, 1976). Note that fence line monitoring includes any contribution from the adjacent Studsvik facility, which is a State of Tennessee licensee that processes low-level radioactive wastes.

Table 3-16. Results of Direct Radiation Monitoring at the Fence Line*

Year	TEDE (mrem)	TEDE (mSv)
2009	13	0.13
2008	16	0.16
2007	15	0.15
2006	25	0.25
2005	35	0.35

*NFS. "Response to the Request for Additional Information Regarding the Environmental Assessment for Nuclear Fuel Services, Inc. Materials License SNM-124 Renewal." Docket No. 70-143. Erwin, Tennessee: NFS. 2010.

As discussed in Section 2.4, NFS monitors both stacks and water, including waste water and storm water, and compares the radioactivity in water to the concentration limits in 10 CFR Part 20, Appendix B. Figure 3-9 shows the maximum fraction of the Appendix B limits measured in water between 2004 and 2009. NFS demonstrates compliance for stack releases by calculating the dose to the MEI instead of relying on radioactive emission measurements at the stack. Between 2004 and 2009, NFS released radioactivity between 1.27 and 8.74 times the air effluent limits in 10 CFR Part 20, Appendix B. However, dispersion of the radioactivity in air greatly reduced the concentration at offsite locations to levels that averaged 0.02 percent of the Appendix B values for air concentration. The dose associated with this fraction is 0.001 mSv [0.01 mrem].

NFS operations result in the use and release of several nonradiological constituents both to the air and to water. The nonradiological constituents, designated as Criteria and Hazardous Pollutants, are listed in Table 2-1 for air emissions and Tables 3-12 and 3-13 for water effluents. Specific limits exist for each criteria and hazardous pollutant. Unlike radiation, however, no method exists for determining the detriment to public health from multiple pollutants. In addition to listed and hazardous pollutants, NFS uses other hazardous chemicals including ammonium hydroxide, hydrogen, nitric acid, sodium hydroxide, sodium hydrosulfide, and sulfuric acid. Further, several organic compounds are present at the NFS site, including perchloroethylene; trichloroethylene, 1,2-dichloroethylene, vinylchloride, and tributylphosphate.

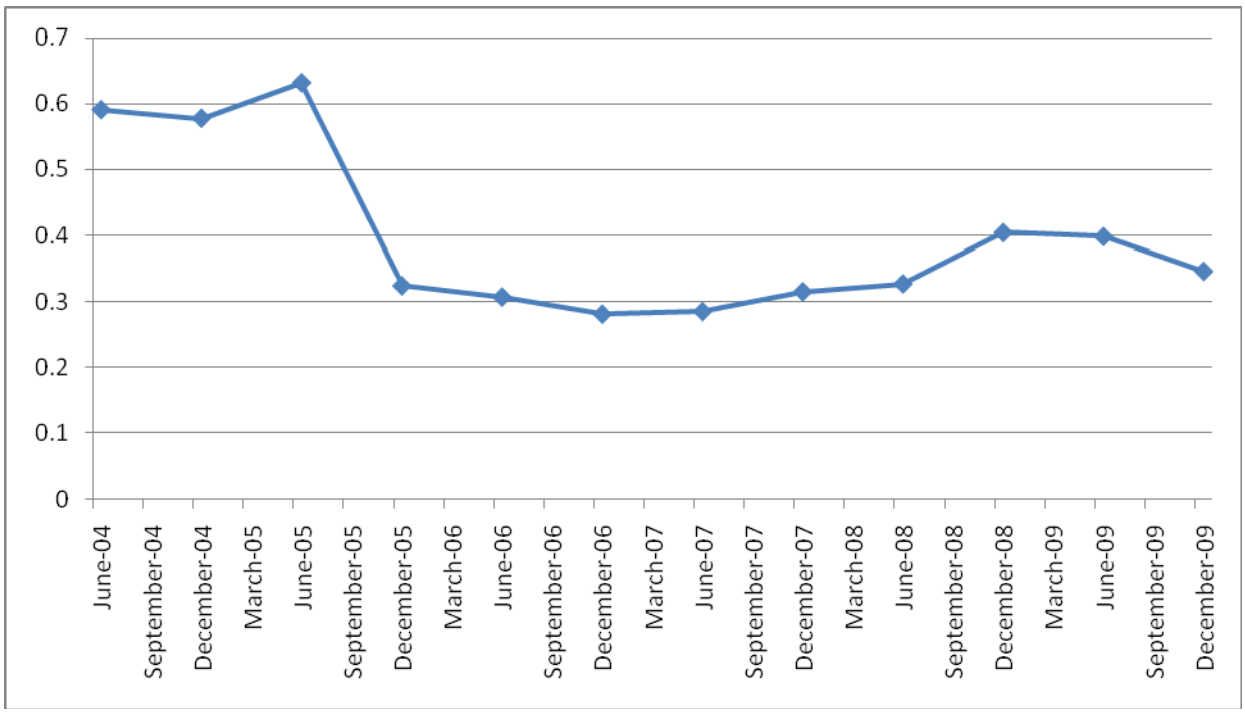

Figure 3-9. Maximum Concentration of Radioactivity in Water as a Fraction of the Water Concentration Limits in 10 CFR Part 20, Appendix B (Ward, 2010)

3.11.1 Accidents

The NFS Environmental Report (NFS, 2009b) described accidents with the potential for off-site consequences. These accidents included (1) nuclear criticality, (2) uranium hexafluoride (UF6) release, (3) uranium solution release, (4) major fire, (5) natural phenomena, and (6) security emergency. The description is consistent with the accident analysis in the NFS Emergency Plan which has been reviewed and approved previously by NRC staff. The Emergency Plan was included in the license renewal application by reference with no changes. The maximum off-site consequences from these accidents occur either at the site boundary or at the nearest resident within a few hundred meters of the plant. Protective action recommendations in the emergency plan include areas within 1 mile of the plant and the Nolichucky River up to 10 miles downstream of the plant.

4.0 ENVIRONMENTAL IMPACTS

The NRC staff reviewed the NFS environmental report; collected information from local, regional, state, and federal government agencies; and independently evaluated the environmental impacts to the various resources of the affected environment from the proposed action and the reasonable alternatives. In conducting its evaluation, the staff applied the guidelines outlined in NUREG–1748 (NRC, 2003). Generally, in its NEPA evaluations, the NRC staff categorizes potential impacts as follows:

- SMALL—environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource

- MODERATE—environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource

- LARGE—environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource

The NRC staff's analysis of potential environmental impacts from the proposed 40-year license renewal relies on (1) NFS's forecast of activities over the proposed 40 years, and (2) data that reflect current site conditions, activities, and effluent levels. As such, unless otherwise noted, the NRC staff is not relying on the analysis in the 1999 license renewal EA (NRC, 1999) as a basis from which impact conclusions are drawn.

4.1 Land Use

The NRC staff's analysis of potential environmental impacts to land use consists of an evaluation of changes in land use from the proposed action, reasonable alternatives, and the no-action alternative.

Under the proposed action, NFS indicates that it does not plan significant changes in onsite land use in the near future and, with renewal of the license, all major operations would continue to be conducted within the Plant Protected Area (see Section 3.1). As described in Section 3.1, onsite land use has not changed since the construction of the BLEU complex when NRC staff previously evaluated the environmental impacts associated with the site (NRC, 2002). With respect to longer term potential impacts for a 40-year renewal alternative, any changes to the NRC-licensed activities, including those that would involve either construction of new processing facilities or decommissioning of existing facilities, would require NFS to submit an amendment request for NRC review. The NRC staff would evaluate the specific environmental impacts associated with the proposed changes as part of its NEPA review process at that time. Thus, NRC staff determines that the impact on land use in the surrounding area for the proposed action would be SMALL.

For the no-action alternative, the NRC license would not be renewed and NFS would be required under 10 CFR 70.38(d) to prepare a detailed decommissioning plan for the site and for subsequent license termination. This plan would be submitted for NRC review, and the NRC staff would evaluate specific land use impacts associated with decommissioning and decontamination activities at that time. In the short term, it is anticipated that decommissioning and decontamination activities, and therefore land use impacts, would largely be confined to the existing Plant Protected Area. After the site was decommissioned and the NRC license terminated, the land would become available for other uses either with or without institutional

controls on future land use options, depending on NRC conditions for license termination and the Town of Erwin zoning restrictions for the area. Long-term impacts to land use would depend on the new tenants of the site. Expected impacts to land use from the no-action alternative would be at least MODERATE, given the change in use from a nuclear fuel fabrication facility to a future indeterminate use.

Cumulative impacts to past land use include changes such as NFS and Studsvik facilities construction, development of the adjacent properties in the Riverview Industrial Park, and expansion of the CSX railroad facilities. While commercial and residential developments have expanded near Erwin since the facility was built in the 1950s, the surrounding area outside of the city limits remains fairly rural and undeveloped. As shown in Table 3-2, the land use area within 1.6 km [1 mi] of the site is predominantly residential, with limited commercial and industrial uses. Because NFS has not identified any significant changes to ongoing operations as part of the proposed action of a 40-year license renewal period, continued NFS site operations during the license renewal term would not be expected to change land use or development rates in the area. NRC staff concludes that the cumulative impact on land use in the surrounding area for the proposed action would be SMALL.

4.2 Transportation

The NRC staff's evaluation of transportation impacts from the proposed license renewal considers the impacts to local traffic and the non-radiological and radiological public and occupational safety impacts from incident-free transportation and from potential transportation accidents. Transportation activities associated with the license renewal are discussed in Section 2.3.4.

Under the proposed action, NFS is proposing no changes to currently licensed operations. Therefore, the type and magnitude of transportation activities are expected to be similar to those of prior operations. To evaluate the impacts of the proposed transportation on local traffic, the staff compared the magnitude of proposed transportation activities with the existing traffic volumes near the site (Section 3.2). Based on the information in Table 2-4, daily workers commuting to and from the site contribute the largest number of average daily vehicles from proposed operations. As shown in Table 4-1, if the estimated 1,662 daily worker commuting trips are allocated to each road segment listed in Table 3-3, the contribution to the most recent (2008) annual average daily traffic is from 20 to 27 percent for the Erwin roads and 10 percent of the traffic on Interstate 26. Similarly, other shipping activities associated with the proposed action (approximately 588 truck shipments including annual decommissioning waste shipments), if allocated to each road segment, represent an additional 7 to 10 percent of the annual average daily traffic in Erwin and 4 percent of the traffic on Interstate 26.

Table 4-1. Contribution of NFS-Related Transportation Activities to the 2008 Average Annual Daily Traffic Count for Roads Near the NFS Site

Road and Location	2008 Traffic Count*	NFS Commuting Traffic	% of 2008 Traffic	NFS Shipping Traffic	% of 2008 Traffic
Jackson Love Highway Between Carolina Avenue and Interstate 26, Erwin	7,604	1,662	22	588	8
South Main Avenue at Tucker Street, Erwin	7,560	1,662	21	588	8

Table 4-1. Contribution of NFS-Related Transportation Activities to the 2008 Average Annual Daily Traffic Count for Roads Near the NFS Site

Road and Location	2008 Traffic Count*	NFS Commuting Traffic	% of 2008 Traffic	NFS Shipping Traffic	% of 2008 Traffic
State Highway 107 Between North Main Avenue and Interstate 26, Erwin	5,804	1,662	27	588	10
North Main Avenue Between 5th and 6th Streets, Erwin	8,272	1,662	20	588	7
Interstate 26 West of Erwin	16,230	1,662	10	588	4
*Average Annual Daily					

Because the magnitude of transportation activities associated with the proposed action is a sizeable fraction of existing traffic for local roads, NRC staff concludes the NFS impact to local Erwin average daily traffic would be MODERATE, but the area affected should be localized around the NFS site, given the short distance from the plant site to the interstate and the available capacity of the interstate. Furthermore, because NFS is not proposing major changes to current operations, the local transportation impacts would represent a continuation of existing levels of traffic. The percentage contribution of traffic from the proposed action to Interstate 26 traffic is small, and therefore impacts to Interstate 26 traffic would be SMALL. The NRC staff concludes that the overall impact on traffic for the proposed action would be SMALL given (i) existing site operations would continue without significant changes in transportation activities, (ii) the contribution to Erwin traffic would be localized, (iii) the impacts would be similar to ongoing conditions, and (iv) the contribution to Interstate 26 traffic would be a small fraction of existing traffic.

The potential non-radiological impacts from transportation accidents including traffic accident fatalities have been previously evaluated. In the previous license renewal EA (NRC, 1999), NRC calculated less than one (0.72) fatality would be expected from shipping 2,874 shipments of contaminated soil from proposed decommissioning activities to a licensed disposal facility in Clive, Utah. Based on the lower estimated number of decommissioning shipments provided in Table 2-2 for the proposed action (1,732) and the comparable shipment distances that would be traveled (either to Clive, Utah, or the Nevada Test Site), the NRC staff concludes decommissioning shipments for the proposed action would present a lower fatal accident risk than that previously calculated for the last license renewal. Therefore, NRC staff concludes that the transportation impacts from decommissioning activities would be SMALL.

Compliance with NRC and U.S. Department of Transportation packaging and transportation regulations (10 CFR Part 71 and 49 CFR Parts 100–180) provides protection for workers and the public from exposure to unsafe levels of radiation during transport and limits the potential for releases of hazardous and radioactive materials during transportation accidents. These regulations address a variety of factors related to safety including packaging, labeling, signage (placarding), driver qualifications, routing, incident reporting, and emergency preparedness. Roles and responsibilities of shippers, carriers, first responders, and applicable state and federal agencies are established in these regulations or by other coordination actions to ensure prompt response and support is provided for incidents involving releases of hazardous (including radioactive) materials during transport. The staff concludes the existing regulatory framework and shipping practices provide adequate protection of public health and safety from

potential hazards associated with the proposed continuation of radioactive and hazardous materials transportation activities.

While the existing regulations address the fundamental safety concerns associated with transportation of hazardous materials, quantitative risk calculations provide additional technical insights into the potential radiological and non-radiological risks of the proposed shipping activities. DOE previously analyzed incident-free and accident radiological and non-radiological impacts for uranium downblending-related transportation activities (including NFS downblending activities) in a final environmental impact statement (FEIS) for Disposition of Surplus High Enriched Uranium (DOE, 1996). That analysis supported a TVA record of decision (TVA, 2001) on the uranium downblending project that concluded environmental impacts from the downblending program, which included the proposed NFS transportation activities, were low. Estimated fatalities from the entire shipping campaign were fewer than one (TVA, 2001) with the greatest contribution from non-radiological traffic accident fatalities. NRC previously reviewed the 1996 DOE FEIS and the TVA record of decision and incorporated them by reference into a prior NRC environmental review for the NFS downblending activities (NRC, 2002). Since that time, DOE evaluated (DOE, 2007) whether the transportation impact calculations in the 1996 FEIS needed to be supplemented to address changes in parameters, assumptions, environmental conditions, or programs. DOE concluded that additional analyses would not substantially change the impact conclusions in the 1996 FEIS (DOE, 2007).

NRC has also previously evaluated the incident-free radiological risks of transporting various radioactive materials (NRC, 1977) that include materials similar to those considered in the proposed action (i.e., natural uranium oxides, uranium hexafluoride, enriched uranium hexafluoride, enriched uranium oxide, and non-irradiated fuel elements). The calculated annual radiological risk for radioactive material shipments nationwide in 1975 was small (about 1 latent cancer fatality) and, when considered along with the more recent DOE FEIS analyses, provides additional support for the conclusion that the proposed transportation activities can be conducted safely without imposing significant radiological risks to public health and safety. Therefore, NRC staff concludes that the impact to public health and safety from transportation activities for the proposed action would be SMALL.

The 10-year license alternative would proportionally reduce the cumulative magnitude of operational transportation activities for the life of the site. Impacts for the shorter renewal period would be expected to be similar to those described for the 40-year renewal (e.g., contributions to traffic; an incremental increase in risks from incident-free and accident non-radiological and radiological transportation to workers and the public). However, the impacts would be limited in duration given the shorter license renewal period. Considering the impacts for the proposed 40-year renewal are SMALL, the NRC staff determines that the impacts from transportation for the alternative of a 10-year renewed license also would be SMALL.

Under the no-action alternative, NFS would be required to begin full site decommissioning following NRC approval of the site decommissioning plan. Full site decommissioning could temporarily increase transportation activities at the site until decommissioning was completed. Because full decommissioning is not part of the proposed action, the net effect of the no-action alternative on transportation would be to eliminate the operational transportation impacts discussed previously for the proposed action and add transportation impacts associated with full site decommissioning. Transportation activities associated with decommissioning include commuting workers, shipments of supplies and equipment, and shipments of waste materials including contaminated structures, equipment, and soils. Based on this information, potential impacts from the no-action alternative would be SMALL to MODERATE. NRC will evaluate the

environmental impacts of full site decommissioning when NFS ceases operations and submits a decommissioning plan for NRC review.

Cumulative impacts from transportation activities may result in increased demand on local roads due to residential growth and further development or redevelopment in the industrial sector. To assess the potential cumulative impacts, the NRC staff evaluated local and regional plans that are detailed in the following paragraphs.

The NFS site is located within the Johnson City Metropolitan Transportation Planning Organization (Wilbur Smith Associates, 2008) and within the Town of Erwin in Unicoi County. The Unicoi County land use and transportation plan for 2008 to 2020 (Unicoi County Regional Planning Commission, 2008) projects modest population growth for the Town of Erwin to 2025 (approximately 2.5 percent increase every 5 years). The plan does not identify any specific local capacity challenges and, given the relatively steady population of the town, existing roads are assumed to be sufficient to accommodate a continuation of planned activities at the NFS site.

The Johnson City Metropolitan Transportation Planning Organization's 2030 Long Range Transportation Plan (Wilbur Smith Associates, 2008) provides a regional transportation assessment. This plan indicates Interstate 26 (an expected route for NFS commercial shipping activities associated with the proposed action) currently provides an excellent to average level of service (the level of service is a planning metric that considers traffic volume and roadway capacity). This level of service is projected to degrade to congested or severely congested at locations north of Erwin (from the Johnson City area northwest to Interstate 81) by 2030 if none of the currently planned road improvements are implemented. Planned road improvements are expected to mitigate some but not all of the projected congestion. The plan proposes additional improvements to Interstate 26 to further mitigate the projected congestion. Based on this plan, the staff concludes that portions of the regional transportation network would be expected to experience MODERATE to LARGE impacts from the cumulative increases in transportation from all sources of traffic. Proposed NFS activities would increase current average daily traffic on Interstate 26 by approximately 14 percent if all NFS traffic utilized the interstate (see Table 4-1). This would be a reasonable bounding assumption because most employees would be commuting from Carter, Washington, and Unicoi Counties, which are south of Johnson City and the primary area of concern for traffic impacts along Interstate 26. The proposed level of use would be a small contribution to the projected regional traffic impacts from all sources. Therefore, NRC staff concludes that the cumulative impact on transportation from the proposed action would be SMALL.

4.3 Socioeconomics and Environmental Justice

NRC staff considered each of the following socioeconomic factors for determining socioeconomic impacts: economic and population growth, employment levels, housing units/vacancy rates, available educational services, and health and social services.

Under the proposed action, NFS anticipates modest changes in employment levels at the site with an increase or decrease on the order of 150 employees over the next 40 years (NFS, 2010a). As such, site activities would continue to create steady employment for the affected counties. In Table 4-2, 2009 NFS employee residence locations were compared to the 2010 labor force populations in the ROI counties. As shown, for all of the counties except Unicoi County, NFS employees make up less than 1 percent of the labor force for the county. For Unicoi County, NFS employees comprise nearly 3 percent of the county labor force.

NFS employment levels are not expected to change significantly during the license renewal period, so these percentages are not expected to vary much unless the labor force populations for the ROI counties change dramatically.

Table 4-2. Population Distribution and Percentage Employment by NFS in the Region of Influence*

County	Total Labor Force Population in 2010†	Number of NFS Employees Residing in 2009	Percent Employed by NFS
Carter County, TN	30,210	116	0.38%
Greene County, TN	30,130	17	0.06%
Sullivan County, TN	75,640	50	0.07%
Unicoi County, TN	8,460	249	2.94%
Washington County, TN	63,100	356	0.56%
Total in ROI	207,540	788	0.38%

*NFS. "Environmental Report." SNM License No. 124. Docket No. 70-143. Erwin, Tennessee: NFS. May 2009.
† http://www.tennessee.gov/labor-wfd/labor_figures/aug2010county.pdf. (October 8, 2010).

NFS also would be expected to pay applicable local, county, and state taxes, and the facility and its employees would continue to support the local communities through purchases of various services. While the monetary amount of the tax and purchasing support may vary over time, such support would be expected to continue throughout the renewal period. Given that NFS anticipates only modest changes in employment under the proposed action and the relatively small percentage of the total labor force represented by NFS employees, the NRC staff expects impacts to available housing, education, or health and social services to be small. Therefore, NRC staff concludes that the socioeconomic impact of the proposed action would be SMALL.

The no-action alternative could result in an adverse socioeconomic impact by reducing the number of employed professional, scientific, management, and administrative staff positions. A significant portion of the 829 NFS employees (as of 2009, see Table 2-6) would be expected to immediately lose their jobs, as the site activities would transition from operations to decommissioning. During the decommissioning phase, a short-term construction labor pool would exist; however, an increase in the unemployment rate for the affected counties would not be anticipated.

Because more than 85 percent of NFS employees live in Washington, Unicoi, and Carter Counties (Table 2-7), these counties would more likely experience the socioeconomic impacts of full site decommissioning and final site shut down. Further, tax revenues in the ROI would be impacted as well, especially in Unicoi County. Therefore, NRC staff determines that the socioeconomic impact from the no-action alternative would be SMALL for the ROI but MODERATE for Unicoi County.

The continued operation of NFS is not likely to result in significant cumulative impacts for any of the socioeconomic impact measures assessed in this draft EA (public services, housing, and offsite land use). The 26 manufacturing companies currently in Unicoi County are described in

Section 3.1. The four manufacturing companies that employ the largest number of workers other than NFS manufacture tires, metals, ceramic fibers and silica shrouds, and plastics (TDEC, 2008). NFS is not dependent on any of these companies for its continued operation and, therefore, no cumulative socioeconomic impacts to these companies would be expected. Furthermore, NFS is not changing its scope of activities under the proposed action. Therefore, NRC staff concludes that the cumulative socioeconomic impact from the proposed action would be SMALL.

4.4 Air Quality

Potential impacts on air quality for the affected environment can result from gaseous effluents released from NFS activities. The effluents may contain radiological and non-radiological chemical constituents. As described in Section 2.3.1, non-radiological air emissions are regulated under permits issued by the Tennessee Air Pollution Control Board (Table 1-1). Permitting is the mechanism to implement plans and policies to protect the air quality and control air pollution as described in the Clean Air Act. Radiological air emission impacts are discussed in Section 4.11.

Because NFS is proposing no changes to current operations for the proposed action, air emissions and effluent treatments that have been used during the current license term would continue if the license was renewed. Table 2-1 contains the current allowable and the estimated annual NFS site air emission levels for the 17 permit-regulated pollutants. As shown in the table, the estimated site air emission levels are lower than the allowable permit thresholds for all 17 pollutants, with the percentage of estimated emission levels ranging from less than 1 percent up to 71 percent of the allowable emission levels. For thirteen of the pollutants, estimated emissions are less than 50 percent of the allowable thresholds. Annual estimated site emission levels for 12 of the 17 permit-regulated pollutants are less than 1 metric ton [1.1 short ton].

The last three annual air pollution control inspections TDEC conducted beginning in 2007 found NFS to be in compliance with the air permits issued by the Tennessee Air Pollution Control Board. NFS states that there have been no air permit violations since its NRC license was last renewed in 1999 (NFS, 2010a). Institution controls, including the treatment of effluent streams and compliance with state permit limits, control effluent discharges below acceptable levels. Therefore, NRC staff determines that the impact to air quality from the proposed action would be SMALL.

For the no-action alternative, the NRC license would not be renewed and NFS would be required under 10 CFR 70.38(d) to prepare a detailed decommissioning plan for the site and for subsequent license termination. This plan would be submitted for NRC review, and the NRC staff would evaluate the environmental impacts associated with decommissioning and decontamination activities at that time. In the short term, decommissioning could result in an increase in fugitive dust from demolition activities. However, the site would still be regulated under the state air permit(s) during this time. License termination would eventually eliminate operational gaseous emissions. After the site was decommissioned and the NRC license terminated, the site would become available for other uses either with or without institutional controls on future land use options, depending on NRC conditions for license termination and the Town of Erwin zoning restrictions for the area. Long-term impacts would depend on the new tenants of the site. Therefore, the NRC staff concludes that the air quality impacts from the no-action alternative would be SMALL as long as monitoring and state regulatory oversight of air emissions continues.

Cumulative impacts to air quality can result from the release of gaseous emissions into the atmosphere from any source around the NFS site. The project is located in Unicoi County, which is in an area in attainment of all NAAQS, as discussed in Section 3.4.2. The three Tennessee counties within the Eastern Tennessee–Southwestern Virginia Interstate Air Quality Control Region that surround Unicoi County are also in attainment for all NAAQS. Further, the NFS site is a significant distance from the nearest PSD Class I area (Great Smoky Mountains National Park). Information in Table 3-10 demonstrates that Unicoi County generates lower emission levels than the four nearest Tennessee counties. For the pollutants listed in Table 3-10, Unicoi County emission amounts range between 1 and 7 percent of emissions from Washington County, which is located about 1.9 km [1.2 mi] from Erwin. This contrast is even greater when compared to Sullivan County located about 28 km [17.4 mi] from Erwin. Unicoi County emission levels are under one percent of the Sullivan County emission levels for all pollutants except volatile organic compounds, which are slightly above 1 percent. As stated in Section 2.2.3.1, NFS greenhouse gas emission levels are below the current thresholds for mandatory reporting requirements. These levels represent less than 0.02 percent of the amount that Tennessee emits annually as estimated in Section 3.4.2, and NFS has had no permit violations since the 1999 license application review.

In summary, the area around the NFS site is classified as in attainment for NAAQS. Additionally, facility emissions are regulated under permits issued by the Tennessee Air Pollution Control Board. The Unicoi County contribution to emission levels is small relative to the surrounding counties, and no change in site operations is anticipated as part of the proposed action. Therefore, the NRC staff concludes that cumulative impacts from the proposed action on local air quality resources would be SMALL.

4.5 Water Resources

4.5.1 Surface Water

Under the proposed action, NFS is proposing no major changes to its current operations regarding the use of or discharge into surface waters that could adversely affect the quality of onsite and offsite surface waters. Historically, radioactivity in surface waters within and near the NFS site has limited distribution and generally occurs at background concentrations or below the NRC's regulatory limits. NRC staff expects the reduction in source area as a result of ongoing sitewide decommissioning and restoration of Solid Waste Management Units (SWMU) and Areas of Concern (AOC) (Table 3-11) to further limit the potential for radioactive constituents to reach surface waters.

Liquid effluents at the NSF site are treated first at the wastewater treatment facility before they are discharged in compliance with state-authorized NPDES permits into the Nolichucky River. Storm water discharge and surface runoff at the NFS site are regulated under a TDEC multisector general NPDES storm water permit. Continued operation of NFS would require renewed discharge and storm water management permits from the State of Tennessee, which NFS is in the process of obtaining (Table 1-1). Therefore, the NRC staff expects that the effect of discharges of treated water and storm water at the site on the quality of surface waters would be mitigated since such discharges would occur under approved permits.

Wetlands A and B located on the north side of the NFS site are in remediation under the USACE regulations. Hence, NRC staff expects that any filling and excavation on wetlands as

part of remediation activities would not have adverse impacts on water quality of wetlands under the USACE permit.

Therefore, the NRC staff concludes that the impacts to surface water quality from the continuation of NFS site activities under the proposed action would be localized and SMALL.

Under the no-action alternative, full site decommissioning and remediation activities would begin following NRC acceptance of NFS' detailed site decommissioning plan. The NRC staff expects that site decommissioning activities would include best management practices, erosion control barriers, and discharges under approved permits. However, due to the expectation of decommissioning activities taking place across the entire site, with the consequent potential of impacts to surface waters, the NRC staff expects impacts to surface water under the no-action alternative would be SMALL to MODERATE.

Future contributions to cumulative impacts to surface water resources within the Nolichucky River would generally occur from those actions that currently cause impacts (e.g., human habitation, urban and industrial development, agriculture). According to the TVA (TVA, 2004), State and Federal programs authorized by the Clean Water Act, including the NPDES and Total Maximum Daily Loads permits, have been implemented in monitoring and managing the water quality of surface waters in the valley. As discussed previously, the NRC staff expects that NFS impacts would be localized and have a SMALL contribution to the cumulative impact on the surface water quality of waters in the Nolichucky River, other area waterways, and wetlands.

4.5.2 Groundwater

Under the proposed action, continued NFS site operations would pose no major changes to the groundwater use, monitoring, and restoration activities. There is existing groundwater contamination, cleanup of which is being conducted under the oversight of the EPA and TDEC. As discussed in Section 3.5.2, a uranium plume is confined in the alluvium, but a chlorinated solvent plume vertically extends into the bedrock and laterally extends offsite toward the Nolichucky River. Historically, these contaminants exceeded drinking water maximum contaminant levels (NFS, 2010a, RAI Response 7, Enclosure C, Attachment 1). However, the source zones for radiochemical and chlorinated solvents (e.g., impoundments, burial grounds, maintenance shop area) and sitewide groundwater have been under remediation. As a result, the uranium plume has been decreased in size by 76 percent and the chlorinated solvent plume has been decreased by 91 percent.

According to a TDEC environmental indicator memorandum for the NFS site (NFS, 2010a, RAI Response 8), the offsite excursion of the chlorinated solvent plume toward the Nolichucky River appears to be stable and controlled. Because there are no known household, public, or industrial groundwater users downgradient of the NFS site (ATSDR, 2007; NFS, 2009b, 2010a, RAI Response 8), the environmental indicator memorandum did not identify any potential risk. Regarding the chlorinated solvent contamination at the site, ATSDR ranked the NFS site as No Apparent Public Health Hazard, as there were no identified exposure pathways whereby the contaminated groundwater beneath the NFS plant would be used as a source of public water (ATSDR, 2007).

In summary, the NFS site has ongoing and planned decommissioning and remediation of solid waste management units, including main source areas for uranium and chlorinated-solvent plumes. NFS has also achieved substantial reductions in the size of both uranium and chlorinated-solvent groundwater plumes as a result of ongoing aquifer remediation. TDEC has

determined that the offsite-extending chlorinated solvent plume is stable and controllable and because there are no water supply wells downgradient of the NFS site, the plume does not pose a risk to drinking water. In addition, NFS maintains a groundwater monitoring network, and works with TDEC and EPA oversight on the remediation of contaminated groundwater. Therefore, the NRC staff concludes that the short-term impact of the proposed action on groundwater resources would be MODERATE while groundwater remediation is ongoing, while the long-term impact would be SMALL following completion of remediation activities.

Under the no-action alternative, full site decommissioning and remediation activities would begin following NRC acceptance of NFS' detailed site decommissioning plan. As part of the activities, remediation of potential source areas and of existing groundwater contamination would continue with TDEC and EPA oversight. As for the proposed action, the NRC staff concludes that the short-term impact of the proposed action on groundwater resources would be MODERATE while groundwater remediation is ongoing, while the long-term impact would be SMALL following completion of remediation activities.

Future contributions to cumulative impacts to groundwater resources around the NFS site would generally occur from those actions that currently cause impacts (e.g., human habitation, urban and industrial development, agriculture). As discussed previously, there are no known household, public, or industrial groundwater users downgradient of the NFS site. Furthermore, ongoing and planned decommissioning and groundwater remediation activities would further reduce groundwater contamination beneath the NFS site, therefore limiting the potential for offsite migration contaminants. Therefore, NRC staff concludes that the cumulative impact of the proposed action on groundwater resources would be SMALL.

4.6 Geology and Soils

Under the proposed action, continued operations at the NFS site pose no major land use changes that could adversely affect geology and soil. However, in section 2.6, NFS has identified several activities that could potentially impact surficial geology (e.g., construction of a new shipping/receiving warehouse, a new entry/exit control point, new parking areas, and associated retention pond). It would be expected that NFS would employ appropriate soil erosion control measures as part of these construction activities. Additionally, potential impacts from these construction activities would be controlled in accordance with the State of Tennessee storm water permit requirements. Therefore, the NRC staff concludes that the impact to geology from the proposed action would be SMALL.

Past soil contamination is located at the north end of the site and is associated with prior activities in that area. Decommissioning of this area is ongoing. In addition, an area of soil contamination is located in the southwestern portion of the NFS site. An NFS evaluation concluded the contamination originated from past storage of process equipment at that location. NFS has removed the most highly contaminated soil, leaving residual contamination above background yet below levels established for the north site decommissioning (Moore, 2002a,b).

Overall soil quality may change as a result of spills, leaks, and inadvertent uncontained ground discharge. However, 10 CFR Part 20 establishes NRC reporting and monitoring requirements in an effort to minimize the impacts to soils. As areas of the NFS site are decommissioned, NRC staff expects the reduction in source area to further limit the potential for contaminants to migrate offsite. Radiologically impacted soils may be removed from the site and transferred to a licensed disposal facility. The NRC staff concludes that the impact to soils from the proposed

action would be SMALL to MODERATE in areas where remediation is ongoing, but SMALL for the overall site.

Under the no-action alternative, NFS would be required to submit to NRC a detailed site decommissioning plan for approval prior to conducting decommissioning and remediation activities. Short-term surficial land disturbance would occur across the site as part of full site decommissioning activities. Impacts would be MODERATE.

Cumulative impacts to geologic and soil resources can result from current and future activities at the site and in the vicinity. As discussed elsewhere, the NFS site and the immediate surrounding area have been extensively disturbed by NFS-related and other activities. Currently, NFS is in the process of completing activities onsite to address impacts and is actively working with TDEC and EPA to design remediation strategies and to investigate onsite contamination (NFS, 2009b). Future activities may involve release of chemicals into soils, resulting in contamination; such contamination would be expected to be remediated. Therefore, the NRC staff concludes that the cumulative impact of the proposed action on geology and soils would be SMALL.

4.7 Ecology

Under the proposed action, potential impacts to ecological resources may result from discharge of stormwater and effluents into streams and from ongoing decommissioning activities. NFS is not planning major construction activities (section 2.6) that would affect local ecology.

As discussed previously, the NFS site resides on 28 ha [70 acres] of land, of which approximately 5.6 ha [14 acres] remain undeveloped (see Table 3-1). This undeveloped land is located mostly near the northern site boundary as open fields, woods, brush, and shrub swamp that could serve as wildlife habitat and provide resources, especially for area birds that can easily travel on and off of the site. However, the area surrounding NFS is dominated by residential development to the northeast, east, and south and by commercial and industrial development to the west, and there are no adjacent large tracts of land connected to the undeveloped areas at the NFS site. Additionally, Banner Spring Branch is enclosed in an underground pipe while onsite and therefore, does not provide habitat or resting areas for water fowl.

Because of the existing site development and ongoing human activity at the site, terrestrial animals are unlikely to spend their lifespan and completely depend on food sources and the nesting habitat found in the relatively small amount of undeveloped land on the site. Additionally, most regional species would not be expected to occur in the developed portion of the site because of extensive disturbance, lack of natural habitat, and availability of suitable habitat in the area surrounding the NFS site.

During the proposed 40-year license renewal timeframe, undeveloped areas that are not mowed or thinned, especially along Martin Creek, would be expected to continue to evolve into a forest community that may attract a variety of plants and animals that are not currently present. Potential impacts to local streams from construction or decommissioning runoff and siltation and the development of undeveloped areas would require mitigation plans and erosion control. Future liquid effluents produced by processing and decommissioning activities would be discharged in accordance with NPDES discharge permits. Future decommissioning activities planned would likely take place on land that has already been developed. Any future expansion plans involving major construction activities would be assessed in a license amendment at

which time potential ecological impacts would be analyzed. Therefore, NRC staff has determined that the impact to ecology from the proposed action would be SMALL.

As discussed in Section 3.7, three federal- and state-listed threatened or endangered species (the Appalachian elktoe, the Virginia spiraea, and the Gray Myotis) are known to occur within the bounds of the Chestoa 7.5-minute USGS quadrangle map, while within the bounds of the Erwin 7.5-minute USGS quadrangle map, no federal- or state-listed threatened or endangered species are known to occur. Habitat for the three species is not found on the NFS site. According to available FWS records, no federally listed or proposed endangered or threatened species occur within the impact area of the proposed action (TDEC, 2009; FWS, 2009). Therefore, threatened and endangered species are not expected to be impacted by the proposed action.

Under the no-action alternative, NFS' NRC license would not be renewed and NFS would be required under 10 CFR 70.38(d) to prepare a detailed decommissioning plan for the site and for subsequent license termination. Decommissioning activities under this plan may result in environmental impacts (e.g., increases in the noise levels due to the demolition activities, and impacts to stream banks and increased sedimentation) that could affect the local ecology. Terrestrial species would be expected to avoid the loud noises and activity associated with decommissioning. Earth-moving equipment and activities could cause increased sediment to be washed into the creeks and change the water quality, potentially affecting the plants and aquatic animal species. Increased use of vehicles and machinery could increase the amount of dust in the air, which could settle on forage, making the plants less edible or inedible for animals. It is expected that a full site decommissioning plan would address potential impacts such as these. Following the completion of full site decommissioning and subsequent license termination, the site would become available for other uses or could remain unoccupied depending on use restrictions. Therefore, the NRC staff expects that impacts to ecology from the no-action alternative would be SMALL to MODERATE.

With respect to cumulative impacts, the Tennessee Wildlife Resources Agency Erwin State Trout Hatchery is located approximately 183 m [600 ft] upstream of the NFS site on Love Spring Branch, a tributary to Martin Creek. Fish hatcheries generally operate under a discharge permit with limitations of settleable and suspended solids. However, increased sedimentation from a hatchery is expected near the point of discharge or further downstream in the opposite direction from the NFS site. On the basis of these considerations, the NRC staff has determined that NFS operations during the license renewal term would not change current levels of cumulative impacts and that the incremental contribution of NFS operations to cumulative impacts on ecological resources, including threatened or endangered species, would be SMALL.

4.8 Noise

Under the proposed action, current operations would continue with no new major expansion or change in activities. Therefore, NRC staff does not expect noise levels to increase.
As discussed in Section 3.8, current noise levels are primarily associated with vehicle traffic noise, which contributes to the noise levels one would expect in an industrial area of a city. The Town of Erwin and the State of Tennessee have not established permissible noise levels for industrial facilities at the industrial site boundary. There have been no noise-related complaints and noise levels are similar to those at nearby facilities. Therefore, NRC staff has determined that the impact on noise levels from the proposed action would be SMALL.

For the no-action alternative, NRC staff concludes that an increased noise level would be expected due to site decommissioning for the duration of decommissioning activities. These activities could involve heavy equipment operation and building demolition. NRC staff has determined that the impact on noise for the no-action alternative would be SMALL to MODERATE.

Cumulative impacts to noise include noise emissions from surrounding facilities, traffic noise from the adjacent roadways, and industrial noise from neighboring manufacturing businesses. No plans for expansion of the industrial park described in Section 3.1 have been identified and there are no plans for NFS plant expansion as part of the proposed action. Therefore, NRC staff has determined that the cumulative impact on noise from the proposed action would be SMALL and would not result in an incremental change to current local noise impacts.

4.9 Historic and Cultural

As discussed in Section 3.9, NFS property does not appear on the NRHP listing nor does the site have any National Historic Landmarks. The nearest NRHP sites are located more than 2.4 km [1.5 mi] from the NFS site and are unaffected by NFS operations. The proposed action will not result in expansion of NFS facilities or operations onto undisturbed land, and therefore NRC staff finds that the impacts to potential historic or cultural resources would be SMALL.

No prehistoric or historic archaeological sites have been identified on the NFS site (NFS, 2009b). The Tennessee State Historical Preservation Office has stated that no cultural resources exist on the site. Therefore, NRC staff has determined that the cumulative impact on cultural resources for the proposed action would be SMALL.

For the no-action alternative, site decommissioning would not require development of undisturbed areas. Therefore, NRC staff has determined that the impact on historical and cultural resources for the no-action alternative would be SMALL.

4.10 Scenic and Visual

The site is within a parcel of land zoned as industrial in the town limits of Erwin, Tennessee. Because of its industrial nature with little undeveloped land, the aesthetic and scenic quality of the NFS site is currently low and does not provide a favorable landscape for viewing. No scenic areas are located within the immediate area of the site, although scenic sections of the Nolichucky River and the Appalachian Trail are located within 3.3 km [2 mi]. As discussed in Section 3.10, regional historic properties would not be disturbed by the proposed action, because of their distance from the site. Ongoing construction of a security wall around the perimeter of the main NFS site started in 2007 (NFS, 2009b). Except for completing the security wall, NFS does not propose any new major construction activities for the proposed action. Therefore, NRC staff has determined that the impact on scenic and visual resources for the proposed action would be SMALL.

For the no-action alternative, the NRC license would not be renewed and NFS would be required under 10 CFR 70.38(d) to prepare a detailed decommissioning plan for the site and for subsequent license termination. This plan would be submitted for NRC review, and the NRC staff would evaluate the potential visual/scenic impacts that would result from decommissioning activities, such as structure demolition, decontamination activities that alter the landscape, and the use of equipment onsite. As full site decommissioning proceeds, the site over the short term would be in various stages of disarray, with buildings being de-constructed, demolition materials

being staged and then loaded for offsite disposal, and the equipment involved in decommissioning in use and movement across the site. For these reasons, the short term scenic and visual impacts would be MODERATE. After the site is decommissioned and the NRC license terminated, the long-term no-action alternative impact would depend on the property use and construction plans of the next occupant. Therefore, the long-term impact on scenic and visual resources from the no-action alternative cannot be specified.

Cumulative impacts of past visual changes include construction of the NFS site and development of the adjacent properties. While some expansion of commercial and residential developments has occurred in the Erwin Extra Territorial Jurisdiction since the site was established in the 1950s, the surrounding area outside of the city limits remains fairly rural and undeveloped. Opportunities for the Town of Erwin or surrounding communities to expand in the valley where the NFS site is located are primarily restricted to the lower, flat valley bottom from where a direct view of the NFS site is limited. It is unlikely that development would expand onto the steep mountain sides surrounding the valley with a direct view of the NFS site. Continued operations during the license renewal term are not expected to change visual/scenic resources in the area. As a result of these factors, NRC staff has determined that the cumulative impact on scenic and visual resources would be SMALL.

4.11 Public and Occupational Health

By license, NFS is required to implement radiological monitoring and safety programs that comply with 10 CFR Part 20 requirements to protect the health and safety of workers and the public. NRC periodically inspects the NSF programs and has assigned two onsite resident inspectors to inspect for compliance. Worker and public radiological safety at the NFS site is maintained by implementation of a radiation protection program that complies with the regulations in 10 CFR Part 20. The NRC detailed review of that program is documented in the NRC SER.

A measure of the occupational health impact of NFS operations compared to other chemical facilities can be obtained by comparing the recordable and lost-time incident rates at NFS to the average rates for all chemical facilities throughout the nation. The incident rates for 2005 through 2009 are given in Table 3.12. Between 2005 and 2009, the NFS recordable incident rate has varied between 1.81 and 3.92 per 200,000 worker hours. This range is consistent with the average recordable incident rate range for all chemical facilities in the United States of 2.1 to 2.7 per 200,000 hours worked. The lost time incident rate at NFS ranged from 0 to 0.66 per 200,000 hours worked and is consistent with the national average range of 0.6 to 0.7 per 200,000 hours worked. Operations at NFS include decommissioning activities that involve the use of heavy equipment that is normally associated with the construction industry. The recordable and lost-time incident rates for construction are 4.7 and 1.7 per 200,000 hours worked (U.S. Department of Labor, Bureau of Labor Statistics, 2010), which are much higher than those for strictly chemical facilities. The data indicate that the incident rates at NFS are not significantly higher than the rates that are expected for a chemical facility and are lower than those expected from construction. Therefore, NRC staff concludes that the impact to occupational health from non-radiological operations at NFS would be SMALL.

One public health study was conducted in the last 10 years as described in Section 3.11. The ATSDR-conducted study ranked the NFS site as No Apparent Public Health Hazard and concluded that chemical exposures are not at levels likely to cause adverse health impacts (ATSDR, 2007). Therefore, NRC staff concludes that the impact to public health from chemical emissions at NFS would be SMALL.

Public health impacts could occur if sufficient quantities of hazardous or radioactive materials are transported from the NFS site and enter the environment through air, surface water, groundwater, and solid wastes. The potential radioactive contaminants include uranium and other radionuclides listed in Table 3-13 and hazardous chemicals associated with NFS site operations. As described in Chapter 2, an effluent monitoring program is in place at NFS to ensure releases of radioactive materials to the environment are within federal and state regulations and are maintained as low as reasonably achievable.

Public health impacts through air include direct radiation from sources on the site and release of radioactive materials from stacks. Results of direct radiation monitoring at the site boundary (Table 3-16) demonstrate that radiation levels at the site boundary are a small fraction of naturally occurring radiation doses in Tennessee. The highest DDE measured at the site boundary between 2005 and 2009 was 0.35 mSv [35 mrem]; the DDE adjusted for occasional occupancy at the site boundary was 0.022 mSv [2.2 mrem]. Comparing these values to the estimated background TEDE of 3.0 mSv [300 mrem] demonstrates that the maximum dose at the site boundary from direct radiation is less than 1 percent of the background dose and is lower than the regulatory limit of 1 mSv [100 mrem] from 10 CFR 20.1101.

Results of the NFS radioactive stack emission monitoring are reported to the NRC biannually as required by 10 CFR 70.59 (Ward, 2010; Moore, 2009a,b, 2008a,b, 2007a,b, 2006a,b, 2005a,b, 2004). As shown in Table 3-14, the annual radioactive emissions from all stacks combined for calendar years 2004–2009 contributed a TEDE to the MEI that ranged from 0.00002 to 0.000114 mSv [0.002 to 0.0114 mrem]. The dose limit for a member of the public is 1 mSv [100 mrem]; thus, gaseous emissions from NFS result in a TEDE that is just over 1/100th of a percent of the regulatory limit in 10 CFR 20.1101.

As shown in Figure 3-9 for calendar years 2004 through 2009, the largest monthly average concentration of radioactivity in groundwater was 63.2 percent of the liquid effluent concentration limits in 10 CFR Part 20, Appendix B. However, the concentration fraction decreased significantly beginning in the second half of 2005 and has remained consistently lower since that time. As shown in Table 3-15, the TEDE from liquid effluent between 2004 and 2009 ranged from 0.0004 to 0.0011 mSv [0.004 to 0.011 mrem]. This is approximately 0.1 percent of the 0.1 mSv [10 mrem] annual dose limit from combined emissions of radioactive material.

Based on this analysis of measurement data, radiological doses to members of the public from site operations at NFS are significantly below the 10 CFR Part 20 annual limits for dose to the public. Historical and ongoing decommissioning activities have not shown an incremental impact to the MEI or to the population, and their impact is the same as the impact from the proposed license renewal. Therefore, the NRC staff concludes that the impact of radiological operations on public health would be SMALL.

Routine air monitoring is not currently performed for non-radiological criteria and hazardous air pollutants. Table 2-1 indicates that NFS estimates of pollutants to the ambient air are in compliance with applicable guidelines and regulations. However, estimated emissions for several of the compounds are at or marginally below the allowable limits. Monitoring will be performed to verify that the actual emissions of vinylchloride, perchloroethylene, trichloroethylene, Bid-2-ethylhexylphthalate, and mercury do not exceed allowable limits.

Under the no-action alternative, NRC would not renew the NFS license and would require the site to undergo decommissioning. This alternative would eliminate further generation of processing wastes and effluents; however, decommissioning activities would continue to generate emissions of radioactive and hazardous constituents to both water and air as the site is decommissioned and the facility buildings are demolished. Decommissioning activities would be expected to slightly increase public and worker exposures to these hazards for the short term, but it is not expected that the exposures would be greater than public or occupational dose limits or permitted levels. Long term impacts to public health should be limited as site decommissioning standards approved by the NRC staff would be protective of public health and safety, no matter the future use of the site after decommissioning. Therefore, the NRC staff concludes that the impact to public and occupational health for the no-action alternative would be SMALL.

With regard to cumulative radiological impacts, two nuclear facilities licensed by the State of Tennessee are located within 80 km [50 mi] of the NFS site: (1) Studsvik, which is adjacent to the NFS site, and (2) Aerojet Ordnance Tennessee (Aerojet), which is located in Washington County near Jonesborough approximately 16 km [10 mi] from NFS. Radiological monitoring data collected by NFS at its fence line, as shown in Table 3-16, reflect the contribution from both Studsvik and Aerojet. These data show that for the years 2005 to 2009, the TEDE from direct radiation was below the annual public dose limit of 100 mrem in 10 CFR 20.1301. Therefore, the NRC staff concludes that cumulative radiological impacts from the proposed action would be SMALL.

4.11.1 Accidents

The NFS staff assessed the potential environmental impacts of accidents based on the accident analysis information provided in the NFS Environmental Report and the NFS Emergency Plan. Under the proposed action, the following accidents could occur:

1. Nuclear Criticality – An accident involving an uncontrolled, nuclear chain reaction (criticality accident) is possible in several locations at the NFS facility. The accident would produce a sudden release of energy in the form of a high intensity radiation pulse and radioactive fission products which could become airborne. The energy released would disrupt the nuclear chain reaction shortly after it began, however in liquid systems, fissile material can settle over time and produce additional pulses. Of the various locations where a criticality accident could occur, the Waste Water Treatment Facility has the greatest potential for off-site consequences. The analysis estimates a 20 rem dose at the site boundary and a 6.6 rem dose to the nearest resident. No immediate health effects are expected from an acute radiation dose less than 25 rem (NUREG-1391, “Chemical Toxicity of Uranium Hexafluoride Compared to Acute Effects of Radiation;” NRC, 1991). No immediate health effects are expected from the estimated doses of a criticality accident. However, the staff determines that the impact of a criticality accident would be MODERATE based on the need for follow-up medical evaluations.

2. UF_6 Release – UF_6 is a solid at room temperature. It sublimes to a gas when heated and, if released, the gas can react with water vapor in the air to produce a very corrosive acid (HF) and a soluble form of uranium (UO_2F_2). The accident analysis assumes that a cylinder containing approximately 25 kg of UF_6 in engulfed in a fire which ruptures the cylinder. The analysis estimates a 0.38 rem dose at the site boundary. This is much

less than the 25 rem threshold for immediate health effects (NUREG-1391). The analysis estimates an intake of 0.88 mg of uranium. This is much less than the 8 mg intake threshold for transient renal injury (NUREG-1391). In addition, the analysis estimates an HF concentration of 0.4 ppm. This is much less than the 25 ppm concentration that could be tolerated for 30 minutes without any escape-impairing symptoms or any irreversible health effects (NUREG-1391). The staff determines that the impact of a UF_6 release would be SMALL.

3. Uranium Solution Release – Many of the processes at NFS handle uranium dissolved in liquid solutions. The accident analysis evaluated uranium solution releases from several systems. The largest radiation dose was estimated to be 0.23 rem at the site boundary. This is much less than the 25 rem threshold for immediate health effects (NUREG-1391). The largest intake of uranium was estimated to be 30 mg at the site boundary. This is greater than the 8 mg intake threshold for transient renal damage, but less than the 40 mg intake threshold for permanent renal damage (NUREG-1391). Based on the need for medical treatment if an individual has a significant uranium intake, the staff determined that the impact of a uranium solution release would be MODERATE.

4. Major Fire – A major fire is defined as a fire which cannot be controlled by local personnel and equipment. The accident analysis evaluated major fires in several areas. The largest radiation dose was estimated to be 0.55 rem at the site boundary. This is much less than the 25 rem threshold for immediate health effects (NUREG-1391). The largest intake of uranium was estimated to be 8.8 mg at the site boundary. This is slightly greater than the 8 mg intake threshold for transient renal damage, but much less than the 40 mg intake threshold for permanent renal damage (NUREG-1391). Based on the need for medical treatment if an individual has a significant uranium intake, the staff determined that the impact of a uranium solution release would be MODERATE.

5. Natural Phenomena – The accident analysis considered an earthquake, a tornado, a hurricane, and a flood. The analysis concluded that natural phenomena could result in any of the previously described accidents. Therefore, the impact of natural phenomena would be SMALL to MODERATE.

6. Security Emergency – The accident analysis considered sabotage, area intrusion, aircraft crash, train derailment and missile attack. As with natural phenomena, a security emergency could result in any of the previously described accidents. Therefore, the impact of a security emergency would be SMALL to MODERATE.

Overall, the staff notes that exposures from these accidents occur at the site boundary and the presence of an individual at the site boundary during an accident is unlikely. In addition, NRC regulations require that accidents with high consequences must have controls identified and maintained to make the accidents highly unlikely. The authority to possess high-enriched uranium requires NFS to maintain stringent security measures which make security emergencies highly unlikely also. Considering these factors, the staff concludes the overall impact of accidents would be SMALL.

For the no-action alternative, NFS would be required to stop processing operations, ship licensed material offsite to an authorized recipient, and decommission the site. The accidents described above could still occur, but they would become less and less likely as material is removed from the site. The impact of the no-action alternate would be SMALL.

4.12 Waste Management

Under the proposed action, NFS operations would generate a variety of wastes, including radioactive, hazardous, mixed radioactive and hazardous, and nonhazardous solid waste. The proposed NFS waste management practices and waste streams are described in Section 2.3. Because NFS is proposing no changes to current operations, waste generation and waste management practices that have been used during the current license term would continue if the license was renewed.

Worker and public radiological safety for waste management operations at the NFS site are maintained by implementation of a radiation protection program that complies with the regulations in 10 CFR Part 20. The NRC detailed review of that program is documented in the NRC SER. The potential environmental impacts from plant effluents to surface water and air are evaluated in Sections 4.5.1 (surface water), 4.4 (air quality), and 4.11 (public health), and the environmental impacts of waste-management-related transportation are evaluated in Section 4.2.

NFS-generated wastes are either (i) treated and discharged to air or surface water in accordance with applicable state permits, (ii) shipped offsite for recycling or disposal at regulated disposal facilities, or (iii) stored onsite for an indeterminate time until a permitted disposal facility is available. Some waste streams require temporary onsite storage as part of the waste management processes. For liquid waste storage, NFS employs secondary containment structures around liquid waste storage tanks or implements administrative volume limits to contain contents in the event of leaks or spills. Liquid hazardous wastes stored in containers are stored on containment skids that provide secondary containment in case of leaks or spills (NFS, 2010a).

Solid radioactive wastes are stored in approved containers until they are shipped to a licensed disposal facility. Solid hazardous wastes are temporarily stored onsite in a manner that complies with applicable regulations.

Mixed waste that consists of PCB remediation waste or mercury laboratory wastes that are contaminated with radioactive materials are stored for an indeterminate period until a permitted disposal facility becomes available. A TDEC-administered state permitting process regulates mixed waste storage. Radioactive and mixed wastes that are stored in the 310 Warehouse Part B Storage Area are labeled, sealed, and containerized in locked and controlled storage (NFS, 2010a). Because onsite storage of waste includes a combination of physical containment measures, state oversight, and compliance with applicable regulations and permits, NRC staff has determined that the impact from onsite storage of waste materials for the proposed action would be SMALL.

For the proposed action, NFS is expected to annually generate approximately 4,000 m^3 [5,200 yd^3] of radioactive wastes that would require offsite disposal. Based on the data in Section 2.3.3, approximately 3,100 m^3 [1,100 yd^3] of this waste would be disposed at the Nevada Test Site as DOE waste and the remainder would be disposed at the EnergySolutions facility in Clive, Utah as commercial waste. This represents less than one percent of the volume of Class A low-level radioactive waste that is disposed annually at EnergySolutions. The EnergySolutions facility is estimated to have capacity available under its current license to dispose of low-level radioactive waste until approximately 2023 (GAO, 2004). The DOE low-level waste management program at the Nevada Test Site is expected to have available capacity to dispose of low-level radioactive waste until year 2070 (DOE, 2009). While additional

uncertainty exists for disposal of commercial low-level radioactive waste beyond 2023, the NRC staff considers onsite storage to be a safe alternative should there be a future temporary interruption in available disposal capacity. Therefore, based on the available waste management options, the NRC staff concludes that the radioactive waste management impact from the proposed action would be SMALL.

NFS would generate approximately 84.25 m^3 [110.2 yd^3] of hazardous wastes during the proposed 40-year renewal period {approximately ten 208 L [55-gal] drums per year}. These wastes include common industrial wastes that are accepted for disposal at a variety of permitted facilities. The NRC staff expects disposal capacity for these wastes would continue to be available in the future, and the waste management impacts therefore would be SMALL.

Regarding the generation of mixed (radioactive and hazardous) waste, the volume of waste generated, 204.09 m^3 [266.94 yd^3], is equal to about twenty-four 208 L [55-gal] drums per year, or 980 drums for the 40-year license renewal period. As discussed previously, the NRC staff considers that this material can be stored safely, based on the process that is regulated by a TDEC-administered state permit, until a disposal facility becomes available. Additionally, TDEC conducts periodic inspections of the NFS site, sometimes accompanied by the EPA, to evaluate NFS's handling and storage of hazardous and mixed wastes. For these reasons, the NRC staff considers impacts from mixed waste during the proposed 40-year license renewal period would be SMALL.

For nonhazardous solid waste disposal, the regional landfill NFS uses (the Iris Glen landfill located in Johnson City, Tennessee) is expected to be operational until 2022 and has potential for expansion (Draper Arden Associates, 2004). The landfill has been reported to receive 1,360 metric tons [1,500 tons] of waste per day (EPA, 2004). The staff converted this rate to 820,000 m^3 [1.07 million yd^3] per year based on the present operating schedule of 5.5 days per week and assuming operations for 52 weeks per year and a municipal waste conversion factor of 0.47 metric tons/m^3 [800 lb/yd^3]. The estimated annual nonhazardous solid waste generated from the NFS site is approximately 0.001 percent of the annual waste volume the Iris Glen landfill receives. Because the waste volume is a small fraction of the annual volume of waste received, the NRC staff concludes the waste management impacts from nonhazardous solid waste generation would be SMALL.

The staff also reviewed the waste minimization practices NFS employs. This review evaluated whether proposed operations employ measures to reduce the quantities of waste materials and therefore limit potential environmental impacts associated with generating wastes that consume permitted offsite disposal capacity. The staff's review found that waste at the NFS site is minimized by onsite treatment of a variety of liquid wastes at the WWTF, reuse of processing solutions and wastes, decontamination of process equipment, use of distillation and evaporation to reduce the volume of liquid wastes, and application of compaction and recycling to limit the volume of solid waste.

Based on the preceding evaluation of the types and volumes of wastes the proposed renewal generates and the available waste management options and capacities, the staff concludes the overall impacts to waste management resources would be SMALL.

The no-action alternative would not renew the license and require the site to undergo decommissioning. This alternative would eliminate further generation of processing wastes and effluents; however, decommissioning would still generate substantial quantities of low-level waste (e.g., radioactively contaminated structural materials, equipment, and soils) from

decommissioning operations. The no-action alternative would require transportation of stored mixed wastes to another storage facility if no available disposal site were permitted by the time decommissioning is completed. Therefore, the NRC staff concludes that the impact to waste management for the no-action alternative would be MODERATE.

The 10-year license alternative would proportionally reduce the cumulative totals of operational waste volumes for the life of the site. The operational waste volumes described in Section 2.3.3 would be reduced by a factor of approximately four. The nature of the impacts for the shorter renewal period would be expected to be similar to those described for the 40-year renewal, including waste storage, handling, and generation of wastes that require offsite disposal. The impacts, however, would be more limited in duration based on the shorter operational period. With a 10-year operational period, the likelihood that future disposal capacity for low-level radioactive waste would be limited is lower than for the 40-year renewal period. Similarly, the amount of mixed waste that would be generated and stored onsite pending disposal would be reduced by a factor of approximately four. Considering that the impacts for the proposed 40-year renewal would be SMALL, the NRC staff concludes that the impacts to waste management for the 10-year license alternative also would be SMALL**.**

The staff evaluated the cumulative waste management impacts associated with the proposed license renewal and the impacts from other past, present, and reasonably foreseeable future actions. Based on the previous analysis of waste management impacts for the proposed 40-year renewal, the staff considers generation of low-level radioactive waste to be the waste management activity that would most likely contribute to cumulative impacts. The current information regarding low-level radioactive waste volumes that are presently being generated and disposed nationally has been quantified but is still considered somewhat uncertain (GAO, 2004). Future projections at the national level are even more uncertain. As more facilities are decommissioned, the volumes of low-level radioactive waste would be expected to increase. Increases in low-level waste volumes associated with nuclear power plant and DOE site decommissioning have been documented in previous years and future waste volumes that are generated will largely depend on decisions made by DOE and nuclear utilities (GAO, 2004). As previously mentioned, the existing licensed commercial low-level waste disposal capacity at the EnergySolutions facility is projected to be available for the next 13 years and DOE capacity is expected to be available to 2070. These lifetime estimates account for expected commercial and federal waste generation volumes at the national level (GAO, 2004; DOE, 2009). The radioactive waste the proposed renewal generates would create small incremental annual contributions to the national quantities of commercial and federal low-level radioactive wastes that are generated annually. Based on the present and future available waste disposal capacity, the NRC staff expects sufficient capacity will be available for future disposal of the proposed wastes for the next decade or longer. Future shortfalls in disposal capacity could also be addressed safely by temporary onsite storage of wastes. Based on the potential for future increases in low-level radioactive waste generation and uncertainty in commercial disposal capacity beyond 2023, the staff concludes the potential cumulative low-level waste management impacts would be MODERATE over the next 40 years. The proposed action would incrementally contribute a SMALL impact to this MODERATE cumulative low-level radioactive waste management impact over the next 40 years. The cumulative waste management impacts for the 10-year license renewal also would be SMALL because current commercial low-level waste disposal capacity is expected to remain available in the next 10 years. The proposed action would contribute a SMALL incremental addition to this SMALL cumulative low-level radioactive waste management impact.

5.0 AGENCIES AND PERSONS CONSULTED

The NRC staff consulted with other agencies regarding the proposed action in accordance with NUREG–1748 (NRC, 2003). These consultations are intended to (i) ensure that the consultation requirements under Section 7 of the Endangered Species Act and under Section 106 of the National Historic Preservation Act are met, and (ii) provide the designated state liaison agency the opportunity to comment on the proposed action.

The NRC staff contacted the U.S. Fish and Wildlife Service (FWS), by letter dated October 28, 2009, requesting the assistance of the FWS in identifying the presence of endangered or threatened species or critical habitat at the NFS site and in the vicinity. By letter dated December 2, 2009, the FWS notified NRC that, from the information available to the FWS, no federally listed or proposed endangered or threatened species occur within the area to be impacted by the proposed action of renewing the NFS license.

By letter dated October 28, 2009, the NRC staff contacted the Tennessee Historical Commission, requesting the assistance of the Commission in identifying historic properties that may be affected by the proposed action of renewing NFS' NRC license. The Tennessee Historical Commission responded, by letter dated November 19, 2009, notifying the NRC of the Commission's determination that there were no National Register of Historic Places or eligible properties affected by the proposed action.

A copy of this draft EA was sent to the State of Tennessee liaison officer with the issuance of this document for public comment.

6.0 CONCLUSION

Based on its review of the proposed action relative to the requirements set forth in 10 CFR Part 51, the NRC staff has preliminarily determined that renewal of NRC license SNM-124, authorizing operations at NFS's nuclear fuel fabrication facility in Erwin, Tennessee for a period of 40 years will not significantly affect the quality of the human environment. The facility already exists, and no changes to the site or to facility operations are associated with the proposed license renewal. Gaseous emissions and liquid effluents are controlled and monitored by permit and are within regulatory limits for non-radiological and radiological components. Public and occupational radiological dose exposures are below 10 CFR Part 20 regulatory limits. Therefore, based on this preliminary assessment, an environmental impact statement is not warranted, and pursuant to 10 CFR Part 51.31, a Finding of No Significant Impact is appropriate.

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APPENDIX

FLORA AND FAUNA IN THE REGION AROUND NUCLEAR FIELD SERVICES

Table 1. Vegetation in the Nuclear Field Services Region	
Common Name	**Scientific Name**
Pines*	*Pinus,* species unspecified
Oaks*	*Quercus,* species unspecified
Maples*	*Acer,* species unspecified
Sweet Gums*	*Liquidambar styraciflua*
Black Walnuts*	*Juglans nigra*
Weeping Willow*	*Salix sepulcralis*
Persimmon*	*Diospyros virginiana*
Hickory‡	*Carya,* species unspecified
Hemlock‡	*Tsuga canadensis*
Yellow Poplar‡	*Liriodendron tulipifera*
American Beech‡	*Fagus grandifolia*
Sycamore‡	*Platanus occidentalis*
Birches‡	*Betula,* species unspecified
Sphagnum‡	*Sphagnum,* species unspecified
Ferns‡	*Pteridophyta*
Sedges‡	*Carex,* species unspecified
Willows‡	*Salix,* species unspecified
Rhododendron‡	*Rhododendron,* species unspecified
Privet‡	*Ligustrum vulgare*
Cane‡	*Arundinaria,* species unspecified
Button Bushes*	*Cephalanthus,* species unspecified
Goldenrod*	*Solidago*
Sweet Gale*	*Myrica gale*
Goldentop*	*Euthamia,* species unspecified
Pussy Willows*	*Salix,* species unspecified
Swamp Milkweed*	*Asclepias incarnata*
Cardinalflower*	*Lobelia*
Giant Ironweed*	*Vernonia gigantea*
Sweetscented Joe Pye Weed*	*Eupatorium purpureum*
Hazel Alder†	*Alnus serrulata*
Velvet Ash†	*Fraxinus,* species unspecified
Spinulose Woodfern†	*Dryopteris carthusiana*
Philadelphia Fleabane†	*Erigeron philadelphicus*
Blackberry Bushes†	*Rubus,* species unspecified
Tall Fescue*	*Festuca arundinacea*
Switchgrass*	*Panicum virgatum*
Eastern Gamagrass*	*Tripsacum dactyloides*
Orchardgrass*	*Dactylis glomerata*
Bermudagrass*	*Cynodon dactylon*
Johnsongrass*	*Sorghum halepense*
Crabgrass*	*Digitaria,* species unspecified
Sericea Lespedeza*	*Lespedeza cuneata*
Sumac†	*Rhus,* species unspecified
Wild Plum†	*Prunus Americana*
Blackberry†	*Rubus fruticosus*

*NFS. "Response to the Request for Additional Information Regarding the Environmental Assessment for Nuclear Fuel Services, Inc. Materials License SNM–124 Renewal." Docket No. 70-143. Erwin, Tennessee: NFS. 2010.
†Tennessee Native Grasslands Workshop. "The State of the State." January 24, 2007. Murfreesboro, Tennessee: Tennessee Wildlife Resources Agency, University of Tennessee, U.S. Department of Agriculture. <http://nativegrasses.utk.edu/publications/nativegrassconference.pdf> (26 March 2010).
‡U.S. Forest Service. "Final Environmental Impact Statement for the Revised Land and Resource Management Plan." Cleveland, Tennessee: U.S. Department of Agriculture, Forest Service Southern Region. January 2004. <http://www.fs.fed.us/r8/cherokee> (24 March 2010).

Table 2. Birds in the Nuclear Field Services Region		
Common Name	**Scientific Name**	**Habitat**
Black-Throated Green Warbler*	*Dendroica virens*	Forest
Worm-Eating Warblers*	*Helmitheros vermivorus*	Forest
Swainson's Warblers*	*Limnothlypis swainsonii*	Forest
Ovenbirds*	*Seiurus aurocapillus*	Forest
Mourning Doves*	*Zenaida macroura*	Forest
European Starling*	*Sturnus vulgaris*	Forest
Northern Cardinal*	*Cardinalis cardinalis*	Forest
Carolina Chickadee*	*Poecile carolinensis*	Forest
Prairie Warbler*	*Dendroica discolor*	Forest
Field Sparrow*	*Spizella pusilla*	Forest
Louisiana Waterthrushes*	*Seiurus motacilla*	Forest
Ruby-Throated Hummingbird*	*Archilochus colubris*	Forest
Acadian Flycatcher*	*Empidonax virescens*	Forest
Wood Thrush*	*Hylocichla mustelina*	Forest
Blue-Headed Vireo*	*Vireo solitaries*	Forest
Red-Eyed Vireo*	*Vireo olivaceus*	Forest
Scarlet Tanager*	*Piranga olivacea*	Forest
Golden-Winged Warblers†	*Vermivora chrysoptera*	Grasslands
Prairie and Chestnut-Sided Warblers†	*Dendroica pensylvanica*	Grasslands
Northern Bobwhite†	*Colinus virginianus*	Grasslands
Field Sparrow†	*Spizella pusilla*	Grasslands
Yellowbreasted Chat†	*Icteria virens*	Grasslands
Indigo Bunting†	*Passerina cyanea*	Grasslands
Wild Turkey†	*Meleagris gallopavo*	Unfenced Areas
Ruffed Grouse†	*Bonasa umbellus*	Unfenced Areas
Sharp-Shinned Hawk†	*Accipiter striatus*	Small mammal habitat
Cooper's Hawk*	*Accipiter cooperii*	Small mammal habitat
Broad-Winged Hawk*	*Buteo platypterus*	Small mammal habitat
Red-Tailed Hawk*	*Buteo jamaicensis*	Small mammal habitat
Great Horned Owl*	*Bubo virginianus*	Small mammal habitat
Barred Owl*	*Strix varia*	Small mammal habitat

*Tennessee Ornithological Society. "Birdfinding in the Cherokee National Forest, Tennessee." Excerpted with permission from Birdfinding in Forty National Forests and Grasslands. Colorado Springs: American Birding Association. 1994. <http://www.tnbirds.org/birdfinding/ CNFbirding.htm#Unaka> (26 March 2010).
†Hunter, C., R. Katz, D. Pashley, and B. Ford. "Partners in Flight Bird Conservation Plan for the Southern Blue Ridge (Physiographic Area 23)" Version 1.0. Atlanta, Georgia: American Bird Conservancy. 1999. <http://www.blm.gov/wildlife/plan/pl_23_10.pdf> (13 November 2009).

Table 3. Mammals in the Nuclear Field Services Region	
Common Name	**Scientific Name**
Eastern Cottontail Rabbit*	*Sylvilagus floridanus*
Meadow Jumping Mouse*	*Zapus hudsonius*
Raccoon*	*Procyon lotor*
Eastern Gray Squirrel*	*Sciurus carolinensis*
Opossum†	*Didelphis virginiana*
White-Tailed Deer†	*Odocoileus virginianus*
Gray Fox†	*Urocyon cinereoargenteus*
*U.S. Forest Service. "Final Environmental Impact Statement for the Revised Land and Resource Management Plan." Cleveland, Tennessee: U.S. Department of Agriculture, Forest Service Southern Region. January 2004. <http://www.fs.fed.us/r8/cherokee> (24 March 2010). †Hunter, C., R. Katz, D. Pashley, and B. Ford. "Partners in Flight Bird Conservation Plan for the Southern Blue Ridge (Physiographic Area 23)." Version 1.0. Atlanta, Georgia: American Bird Conservancy. 1999. <http://www.blm.gov/wildlife/plan/pl_23_10.pdf> (13 November 2009).	

Table 4. Aquatic Species in the Nuclear Field Services Region	
Common Name	**Scientific Name**
American Brook Lamprey*	*Lampetra appendix*
Longnose Dace*	*Rhinichthys cataractae*
Rainbow Trout*	*Oncorhynchus mykiss*
Brown Trout*	*Salmo trutta*
Mottled Sculpin*	*Cottus bairdii*
Western Blacknose Dace*	*Rhinichthys obtusus*
Central Stoneroller*	*Campostoma anomalum*
Northern Hogsucker*	*Hypentelium nigricans*
White Sucker*	*Catostomus commersonii*
Creek Chub*	*Semolitus atromaculatus*
Banded Sculpin†	*Cottus carolinae*
Rock Bass†	*Ambloplites rupestris*
Redhorse†	*Moxostoma,* species unspecified
Tennessee Shiners†	*Notropis leuciodusa*
Telescope Shiners†	*Notropis telescopes*
Warpaint Shiners†	*Luxilus coccogenisa*
River Chub†	*Nocomis micropogon*
Bigeye Chub†	*Hybopsis amblops*
Blotched Chubs†	*Erimystax insignis*
Stargazing Minnow†	*Phenacobius uranops*
Gilt Darter†	*Percina evides*
Greenside Darter†	*Etheostoma blennioides*
Banded Darter†	*Etheostoma zonale*
Greenfin Darter†	*Etheostoma chlorobranchium*
Smallmouth Bass†	*Micropterus dolomieu*
*U.S. Forest Service. "Final Environmental Impact Statement for the Revised Land and Resource Management Plan." Cleveland, Tennessee: U.S. Department of Agriculture, Forest Service Southern Region. January 2004. <http://www.fs.fed.us/r8/cherokee> (24 March 2010). †Tennessee Wildlife Resources Agency. "Fisheries Report 09-01, Region IV, Trout Fisheries Report 2008." Nashville, Tennessee: Tennessee Wildlife Resources Agency. March 2009. <http://www.twra4streams.org/2008trout.pdf> (29 March 2010).	

Table 5. Rare, Threatened, and Endangered Species Known to Occur in the Erwin and/or the Chestoa 7.5-Minute U.S. Geological Survey Quadrangle Map Area*			
Common Name	**Scientific Name**	**Federal Status**	**State Status**
Vascular Plants			
Climbing Fumitory	*Adlumia fungosa*	Not Listed	Threatened
Chamomile Grapefern	*Botrychium matricariifolium*	Not Listed	Special Concern
Blunt-lobed Grapefern	*Botrychium oneidense*	Not Listed	Special Concern
Piratebush	*Buckleya distichophylla*	Not Listed	Threatened
Roan Mountain Sedge	*Carex roanensis*	Not Listed	Endangered
Spotted Coralroot	*Corallorhiza maculata*	Not Listed	Threatened
Pale Corydalis	*Corydalis sempervirens*	Not Listed	Endangered
Fraser's Sedge	*Cymophyllus fraserianus*	Not Listed	Special Concern
Pink Lady's-slipper	*Cypripedium acaule*	Not Listed	Special Concern†
Mountain Bush-honeysuckle	*Diervilla sessilifolia var. rivularis*	Not Listed	Threatened
Appalachian Gentian	*Gentiana austromontana*	Not Listed	Special Concern
Dwarf Rattlesnake-plantain	*Goodyera repens*	Not Listed	Special Concern
White-leaved Sunflower	*Helianthus glaucophyllus*	Not Listed	Threatened
Cow-parsnip	*Heracleum maximum*	Not Listed	Special Concern
Virginia Heartleaf	*Hexastylis virginica*	Not Listed	Special Concern
Canada Lily	*Lilium canadense*	Not Listed	Threatened
Swamp Loosestrife	*Lysimachia terrestris*	Not Listed	Endangered
Broadleaf Bunchflower	*Melanthium latifolium*	Not Listed	Endangered
Northern Evening-primrose	*Oenothera parviflora*	Not Listed	Special Concern
American Ginseng	*Panax quinquefolius*	Not Listed	Special Concern†
Fringed Black Bindweed	*Polygonum cilinode*	Not Listed	Threatened
Vascular Plants			
Rock Skullcap	*Scutellaria saxatilis*	Not Listed	Threatened
Virginia Spiraea	*Spiraea virginiana*	Threatened	Endangered
Clingman's Hedge-nettle	*Stachys clingmanii*	Not Listed	Threatened
White Heath Aster	*Symphyotrichum ericoides var.ericoides*	Not Listed	Threatened
Southern Nodding Trillium	*Trillium rugelii*	Not Listed	Endangered
Carolina Hemlock	*Tsuga caroliniana*	Not Listed	Threatened
Alleghany Cliff-fern	*Woodsia scopulina ssp. appalachiana*	Not Listed	Special Concern

Table 5. Rare, Threatened and Endangered Species Known to Occur in the Erwin and/or the Chestoa 7.5 Minute U.S. Geological Survey Quadrangle Map Area* (continued)			
Common Name	**Scientific Name**	**Federal Status**	**State Status**
Invertebrate Animals			
Appalachian Elktoe	*Alasmidonta raveneliana*	Endangered	Endangered
Vertebrate Animals			
Highfin Carpsucker	*Carpiodes velifer*	Not Listed	Deemed in Need of Management
Common Raven	*Corvus corax*	Not Listed	Threatened
Hellbender	*Cryptobranchus alleganiensis*	Not Listed	Deemed in Need of Management
Peregrine Falcon	*Falco peregrinus*	Not Listed	Endangered
Swainson's Warbler	*Limnothlypis swainsonii*	Not Listed	Deemed in Need of Management
Gray Myotis	*Myotis grisescens*	Endangered	Endangered
Eastern Small-footed Myotis	*Myotis leibii*	Not Listed	Deemed in Need of Management
Woodland Jumping Mouse	*Napaeozapus insignis*	Not Listed	Deemed in Need of Management
Allegheny Woodrat	*Neotoma magister*	Not Listed	Deemed in Need of Management
Tangerine Darter	*Percina aurantiaca*	Not Listed	Deemed in Need of Management
Weller's Salamander	*Plethodon welleri*	Not Listed	Deemed in Need of Management
Smoky Shrew	*Sorex fumeus*	Not Listed	Deemed in Need of Management

*TDEC. "Tennessee Natural Heritage Program Rare Species Observations for U.S. Geological Survey 8 Digit Hydrologic Unit Code (HUC) Watersheds." Updated July 20, 2009. <http://tennessee.gov/environment/na/pdf/quad.pdf>.
†Commercially exploited