Nuclear Fuel Services, Inc.

Environmental Report for Renewal of Special Nuclear Material License No. SNM-124

Docket No. 70-143; SNM License 124

Prepared for
United States Nuclear Regulatory Commission
Office of Nuclear Material Safety and Safeguards
Division of Fuel Cycle Safety and Safeguards
Fuel Cycle Licensing Branch

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LIST OF ABBREVIATIONS

ALARA	As Low as is Reasonably Achievable
AOC	Area of Concern
AQCR	Air Quality Control Region
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
BLEU	Blended Low Enriched Uranium
BPF	BLEU Preparation Facility
CACO	Consent Agreement and Consent Order
$Ca(OH)_2$	Calcium Hydroxide
CDE	Committed Dose Equivalent
CEDE	Committed Effective Dose Equivalent
CFR	United States Code of Federal Regulations
1, 2-DCE	1, 2 - Dichloroethylene
DOE	United States Department of Energy
EA	Environmental Assessment (as defined in NEPA)
EPA	United States Environmental Protection Agency
EPOTW	Erwin Publicly Owned Treatment Works
FAP	Facility Action Plan
FEMA	Federal Emergency Management Agency
GUDI	Groundwater Under Direct Influence
GW	Groundwater
HEPA	High-Efficiency Particulate Air Filters
HEU	High Enriched Uranium
HVAC	Heating, Ventilation, and Air Conditioning
HSWA	Hazardous and Solid Waste Amendments of 1984
IDLH	Immediately Dangerous to Life and Health
ISA	Integrated Safety Analysis
MCL	Maximum Concentration Limit
MEI	Maximally Exposed Individual
MSA	Metropolitan Statistical Area
NAAQA	National Ambient Air Quality Standards
N/A	Not Applicable
NEPA	National Environmental Policy Act of 1969, as amended
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NFS	Nuclear Fuel Services, Inc.
NIOSH	National Institute of Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System
NRC	United States Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethylene
POTW	Publicly Owned Treatment Works
PSD	Prevention of Significant Deterioration
REA	Regional Economic Area
ROI	Region of Interest
SARA	Superfund Amendment and Reauthorization Act
SNM	Special Nuclear Material

SWMU	Solid Waste Management Unit
TBP	Tributylphosphate
TCE	Trichloroethylene
TDEC	Tennessee Department of Environment and Conservation
TVA	Tennessee Valley Authority
UF_6	Uranium Hexafluoride
UN	Uranyl Nitrate
UNB	Uranyl Nitrate Building
UNH	Uranyl Nitrate hexahydrate
UO_2	Uranium Dioxide
USGS	United States Geological Survey
VCL	Vinyl Chloride
WET	Whole Effluent Toxicity
WWTF	Waste Water Treatment Facility

1.0 Introduction

This report provides environmental information on Nuclear Fuel Services (NFS), Inc., Erwin , Tennessee facility to supplement the Special Nuclear Materials (SNM) license renewal application.

Nuclear Fuel Services, Inc. Environmental Report was prepared in accordance with NUREG 1748, Environmental Review Guidance for Licensing Action Associated with Nuclear Measurements Safety and Safeguards (NMSS).

1.1 Purpose and Need for the Proposed Action

The proposed action is the renewal of NFS SNM-124 license. The SNM-124 license allows the operation of the NFS Erwin facility. The primary licensed activity is the production of nuclear fuel for the United States Navy. This license renewal will also provide the following services for the United States:

- Classified fuel material for the Naval Reactor Program;
- Chemical processing of high enriched uranium material to produce fuel material fabrication and uranium recovery;
- Uranium recovery for DOE; and
- Reduction of weapons grade nuclear material into commercial nuclear power production. NFS is the only facility that produces nuclear naval fuel.

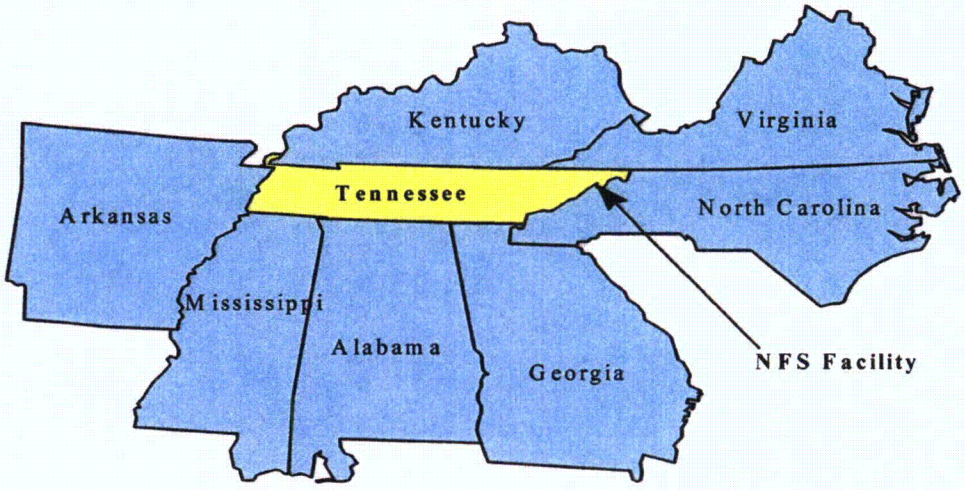
1.2 Proposed Action

The proposed action advocated by this environmental report is the renewal of NFS SNM-124 license and the continued operation of the NFS facility.

Nuclear Fuel Services is located in northeast Tennessee, in Unicoi County, within the city of Erwin. The facility occupies approximately 69.9 acres of land on Banner Hill Road. Banner Hill Road bound the facility on the southeastern side, with the CSX Railroad line on the northwest side, and Martin Creek bounding the northeastern side of the site (see **Figure 1,** NFS Site Location and **Figure 2**, NFS Plant Site and Vicinity).

Nuclear Fuel Services SNM-124 license renewal application will be submitted to the Nuclear Regulatory Commission (NRC) by June 2009.

Figure 1
NFS Site Location



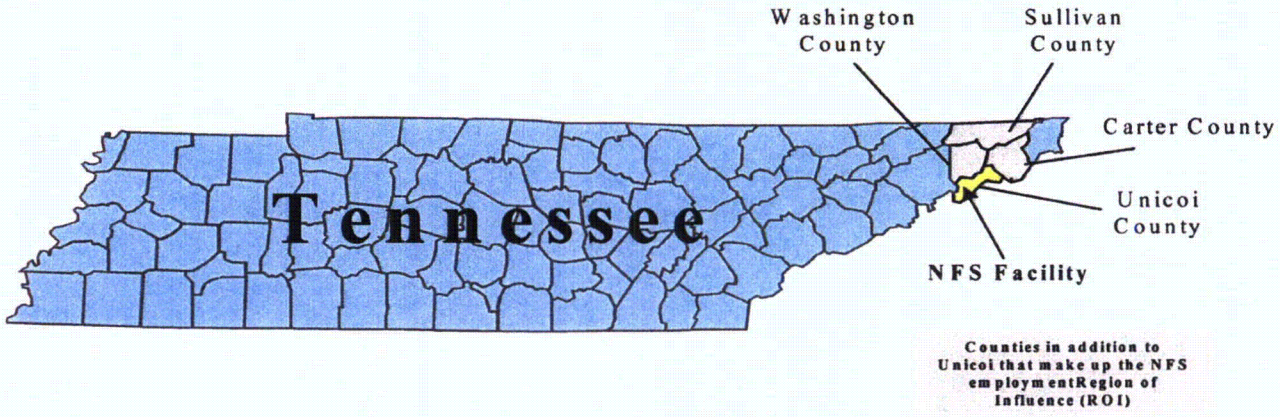
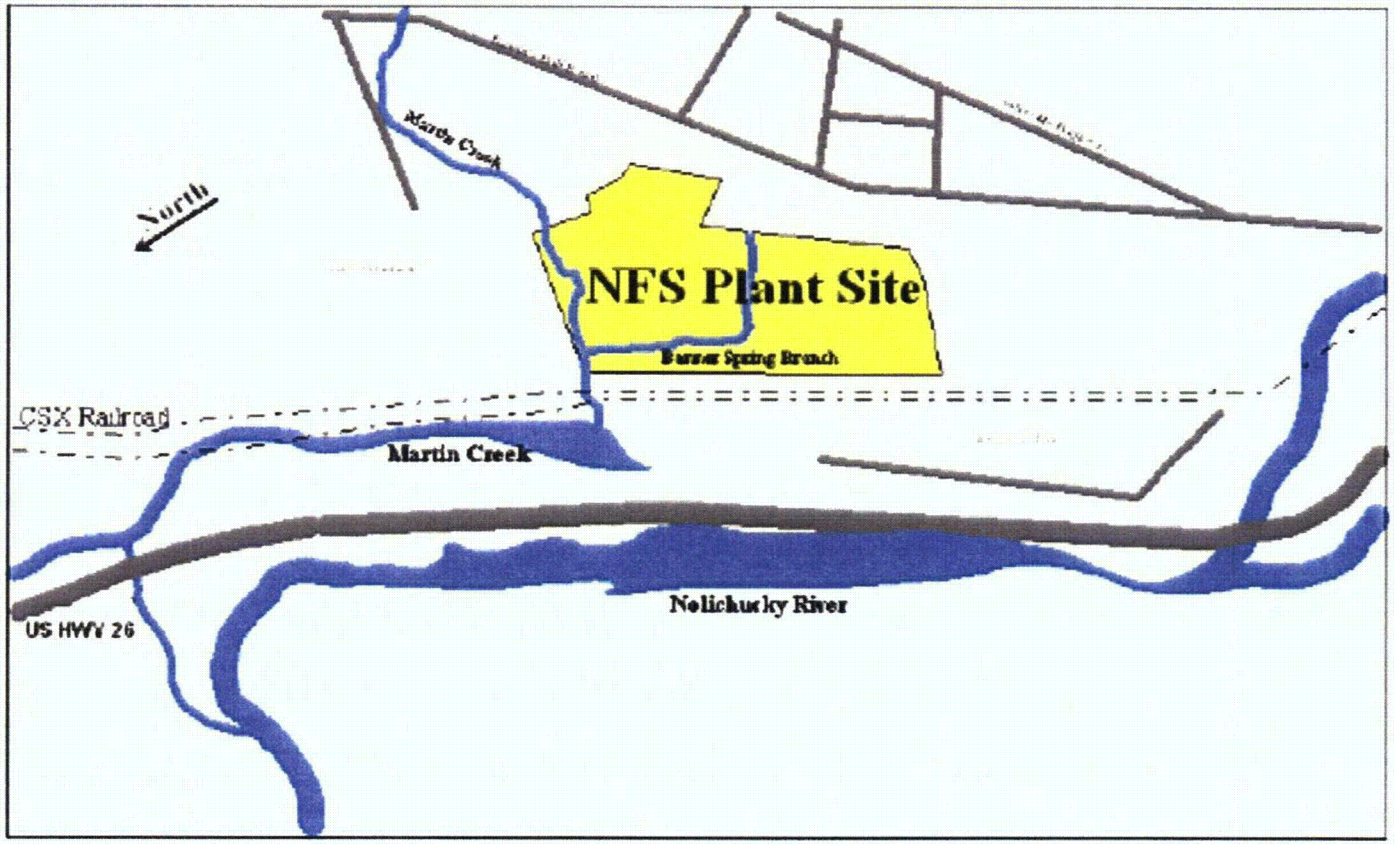


Figure 2
NFS Plant Site and Vicinity



2.0 Alternatives

2.1 Detailed Description of the Alternatives

2.1.1 No-Action Alternative

Failure of the NRC to renew the SNM-124 license would result in a complete cessation of United States Naval Fuel material fabrication, uranium recovery operations, and the conversion of weapons grade high enriched uranium (HEU) into commercial nuclear power. These are valuable assets, which if not conducted by NFS would have to be conducted by another licensed United States facility. The operation of the NFS facility has produced no significant adverse effects on the local environment. Transfer of operations to another licensed facility would have no net positive effect on the environment, but would increase unemployment in the area.

2.1.2 Proposed Action

The proposed action is renewal of SNM-124 license in support of continued operation. This action would include the receipt, possession, storage, and shipment of authorized special nuclear materials. Specific operations are described below:

2.1.2.1 Description of Current Operations

(1)Product Processing
Product processing activities which were carried out during the current license period and which are expected to continue under the renewed license, and similar activities which could occur during the renewed license period, are described below:

- UF_6 Conversion – Conversion of highly enriched uranium hexafluoride to other compounds;
- Fuel Manufacturing – Production of naval fuel containing highly enriched uranium;
- Uranium Recovery – Recovery and purification of highly enriched uranium from scrap generated either internally or at other facilities;
- Enrichment Blending as Liquid uranyl nitrate hexahydrate (UNH) – Enrichment blending of highly enriched uranium with natural uranium or very low enriched uranium to produce low-enriched uranium materials;
- UN Conversion – Low enriched UN solution conversion to uranium dioxide (UO_2) powder
- Ammonia Recovery – Conversion of ammonium diurate (ADU) liquid into ammonium hydroxide

(2) Laboratory Operations
Laboratory activities include wet chemical and physical testing.

(3) General Services
The following general services, ancillary to primary operations occur:

- Storage of special nuclear material compounds and mixtures in areas with containers arranged specifically for maintenance of radiological and nuclear safety;
- Maintenance and repair of special nuclear materials processing equipment and auxiliary systems; and
- Decontamination of equipment and materials, including personnel protective clothing and respiratory devices.

(4) Research and Development

Research and development work is performed on source and special nuclear material compounds and mixtures.

(5) Radioactive Waste Management

The following radioactive waste management activities occur:

- Treating basic and acidic waste streams at the WWTF;
- Decontamination of liquid waste streams and of process equipment;
- Packaging and storage of both liquid and solid wastes contaminated with or containing non-recoverable uranium;
- Shipment of radioactive wastes to licensed facilities or to licensed burial sites for disposal; and
- Volume reduction by compaction, distillation, reuse, and/or evaporation of waste materials containing enriched uranium
- Solidification

(6) Decommissioning

NFS has been actively engaged in decommissioning portions of the Erwin Plant since the mid-1980s. A number of processing buildings and former waste disposal and storage areas have been either fully or partially decommissioned. The North Site Radiological Burial Ground and Pond 4 decommissioning activities are complete with the exception of removing contaminated soil from the North Site area and beneath the former 234 Wet Cell.

The impact of decommissioning activities was evaluated as documented in the NRC's Environmental Assessment (EA) supporting the renewal of the 1996 SNM-124 license. Decommissioning activities are ongoing and have been previously evaluated by the NRC.

2.1.2.2 Waste Confinement and Effluent Control

(1) Gaseous Effluents

Various control devices are used to remove radioactive particulates and chemicals from gaseous effluents. The primary systems are described below:

- Main Process Cleaning System – The Plant's main process ventilation system combines air effluents from essentially all highly enriched uranium processing areas. This combined effluent is cleaned by venturi and demisting scrubbers and HEPA filtration.

- 30% ASHRAE prefilters – Used on HVAC recirculation room air handlers in a large portion of the plant.
- Packed-bed or Sieve Tray Scrubbers – Used in several buildings. Sodium hydroxide, water, and sulfuric acid are used as scrubbing solutions.
- HEPA filters – Used throughout the plant for high-efficiency (99+ %) removal of airborne particulates. In some instances, multiple HEPA filters are used in series to achieve higher removal efficiencies.

(2) Liquid Waste Storage

NFS' waste water storage tanks are housed inside secondary containment structures. The majority of the secondary containment structures are designed to hold the contents of the largest structure, or they are administratively limited. This is a safeguards measure to prevent release of liquid waste to the outside environment.

(3) Liquid Effluents

NFS Waste Water Treatment Facility (WWTF) – The Erwin facility produces liquid effluents from a number of different activities: fuel production, highly enriched uranium recovery, UF_6 conversion, enrichment blending, laboratory operations, laundry activities and facility decommissioning activities. This waste water is batch treated, sampled and then discharged from this on-site WWTF, if levels are below 10 CFR Part 20.1301 and in compliance with the Facility's National Pollution Discharge Elimination System (NPDES) Permit. Treatment typically involves adjustment of pH using sodium hydroxide/sulfuric acid, and precipitation and removal of fluoride ions and uranium through addition of lime slurry, $Ca(OH)_2$. Dissolved ammonia is removed, as needed; using air stripping and the pH is re-adjusted to discharge levels. Discharges are made directly to the Nolichucky River.

Groundwater Treatment – Since 1994 groundwater collected as part of the on-going site decommissioning and remediation has undergone physical/chemical treatment at the site. Volatile constituents are removed by air stripping, and metal removal is accomplished through chemical addition, flocculation, and settling. Treated water is passed through a multimedia filter and an activated carbon bed, prior to neutralization and discharged to the Erwin Publicly Owned Treatment Works (EPOTW).

Sanitary Wastes – Sanitary waste from the NFS site consist of two streams:

1) NFS' main facility: consisting of bathrooms, showers and the Groundwater Treatment Facility.
2) NFS/AREVA NP Blended Low Enriched Uranium (BLEU) Complex: consisting of noncontact cooling water, treated process waste water, and sanitary sewage. The BLEU Complex treated process waste water is batched and sampled for EPOTW permit limits prior to discharge.

The NFS main facility and the BLEU Complex are discharged into two separate pipes under two separate EPOTW permits.

Storm water Run-off – The primary pathway for run-off is from south to north across the plant-site and into Banner Spring Branch and Martin Creek. Banner Spring Branch flows into Martin Creek which subsequently flows into North Indian Creek and then into the

Nolichucky River. Drainage exits the Protected Area through two (2) sluice gate valves into Martin Creek. The gates are in place to allow the flow to be stopped in the event of a spill of hazardous material.

Figure 3A (Liquid Effluent Discharge Points) and **Figure 3B** (BLEU Liquid Effluent Discharge Points) shows the primary liquid effluent discharge points for the Erwin Plant.

(4) Radioactive Solid Waste Management

The site contains various former on-site disposal and storage locations for process wastes and for radioactively contaminated soil and sediment (**Figure 4,** Former Waste Disposal and Storage Areas). No new waste material has been put into these areas since 1978. Currently waste generated on-site is packaged for off-site burial at a licensed radioactive waste disposal facility. Prior to 1978 several on-site areas were used for radioactive material disposal. These are briefly described below.

- The Pond 4 Disposal Area – Process waste burial area. Removal of waste in this area is complete, but excavation of contaminated soil is ongoing.
- Surface Impoundments (ponds) – Three surface impoundments were used for liquid process waste treatment prior to the start-up of the NFS Waste Water Treatment Facility in 1978. Sludge and sediment from the bottom of these former ponds was removed during the period of 1991 to 1994. They have been drained and excavation of contaminated soil is ongoing. They have been renamed Northsite Excavation Area.
- The North-Site Burial Grounds – This was a former 10 CFR Part 20.304 process waste burial area. This was a burial trench for process wastes, laboratory trash, contaminated equipment, and construction rubble. Remediation of the Demolition Landfill and Radioactive Burial Ground began in April 1997. Excavation of debris is complete, but soil removal is ongoing.
- The Southwest Burial Trenches – Two burial trenches containing low-level uranium and thorium contaminated scrap metals and equipment. Excavation of debris and contaminated soil is complete and a final status survey was conducted June 4, 1999 to May 28, 2000.

In addition to the above disposal areas, two on-site areas were used for storage of sediment and soil with elevated radioactivity levels.

- The Soil Mound – Radioactive sediment from the prior location of Banner Spring Branch. Soil has been removed to off-site disposal and confirmatory sampling is planned for this area.
- The South-Site Soil Storage Mound – Gravel covered storage location for radioactively contaminated soil. The contaminated soil was excavated, sampled, and evaluated. The soil was comparable to natural background levels.

(5) Mixed Waste Management

NFS manages "mixed" waste (hazardous waste which is radioactively contaminated) in accordance with applicable federal and state hazardous waste management regulations. NFS has a Hazardous Waste Management Facility permit, issued by the Tennessee Department of Environment and Conservation's Division of Solid Waste Management, which allows storage of specific kinds of mixed waste in containers. Most of the mixed waste stored on site is mercury contaminated waste (waste code: D009) generated by NFS laboratory operations. Much smaller amounts of other mixed wastes (including waste codes: D008, D038, D039) are also stored. At present, a total of forty (40) containers of mixed waste are being stored.

The corrective action conditions for the solid waste management units (SWMU) and areas of concern (AOC) are also included as part of the permit. NFS is required to notify TDEC and investigate any releases of hazardous waste or hazardous constituents at the facility and to take appropriate corrective action for any such releases.

NFS stores on-site PCB liquid waste that is radioactively contaminated. This waste was generated during remediation activities. This waste will have to be stored until a permitted facility becomes available that can accept this type of waste.

NFS periodically conducts mixed waste treatability studies in accordance with applicable federal and state regulations. Such studies have been performed on waste generated by NFS, as well as on waste generated by other entities.

(6) Non-Radioactive Hazardous Waste

NFS generates hazardous waste which is not radiologically contaminated. In accordance with applicable regulations, NFS temporarily stores such waste on-site and then ships it to an authorized off-site treatment, storage or disposal facility.

(7) Non-Radioactive/Non-Hazardous Waste

NFS generates non-radioactive/non-hazardous waste (such as waste oil, paper and cafeteria waste) in the normal course of operations. All waste materials are shipped offsite for treatment, recycling and/or disposal at appropriate facilities.

2.1.2.3 Emergency Preparedness

NFS maintains a detailed Emergency Plan, which specifies accidents with potential off-site consequences. The accidents with potential for off-site consequences are: nuclear criticality, UF_6 release, uranium solution release, major fires, natural phenomena and security emergencies. With the exception of a criticality accident, accidents at NFS are of comparable probability, nature and magnitude with those of non-nuclear chemical processing operations. NFS facilities are designed with extensive engineering and administrative safeguards to preclude most accidents. A summary of postulated accidents potentially having off-site consequence is presented below.

(1) Nuclear Criticality

The possibility of a nuclear criticality accident at NFS is highly unlikely given the design of the systems and the safeguards (both engineered and administrative) governing the operations. All NFS operations incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions to occur before a criticality accident is possible. Although the likelihood of a criticality accident is very low, the potential radiation exposure to the workers and the off-site public has been estimated in order to provide a basis for emergency planning.

Dose projections were estimated for each postulated criticality location for off-site members of the public that may be present at the site boundaries (i.e., the property boundary/line) and the nearest residence, school, business, or office. Dose projections were also estimated for workers at the nearest assembly area from each postulated criticality location (see **Table 1A**, Summary of Potential Doses From Postulated Nuclear Criticality). The dose received at these locations is cumulative resulting from the following contributions:

- instantaneous emission of gamma and neutron radiation, and
- exposure to airborne fission products.

A total of 15 locations on the NFS site where a criticality accident is postulated to occur have been evaluated (see **Table 1A**, Summary of Postulated Dose from Postulated Nuclear Criticality Scenarios). The highest projected total effective dose equivalent (TEDE) to an off-site receptor is 20.41 rem, which is below the upper bound for avoiding serious acute health effects.

(2) UF_6 Release

The offsite impact of a postulated worst-case accidental release of UF_6 from the 300 Complex to the environment has been evaluated. Radiation dose and soluble uranium intakes were estimated for a fire scenario involving a cylinder containing 24.9 kg UF_6 and a maximally exposed individual (MEI) off-site member of the public. Details of the bounding scenario and dose consequences are provided in **Table 1B**.

The major concerns of the postulated release of UF_6 include the hazards associated with radiation dose, chemical toxicity, and hydrogen fluoride (HF) exposure. The maximum exposure receptor would receive the following doses: Total Effective Dose Equivalent (TEDE) of 0.38 rem, a uranium intake of 0.88 milligrams (mg) and a HF exposure of 0.4 ppm.

The worst-case dose of 0.38 rem is less than the EPA Protective Action Guidelines of 1.0 rem TEDE. The uranium chemical intake of 0.88 mg is well below the 2 mg soluble uranium threshold at which emergency plans are required (10 CFR 70.22(i)(l)(i) and the worst-case HF concentration of 0.4 ppm does not exceed the EPA AEGL 1 Level of 1.0 ppm, above which represents only mild, transient effects are expected. Based on the postulated projected doses in comparison with EPA Protective Action Guidelines, the accidental release of a 24.9 kg UF6 cylinder from the 300 Complex does not warrant off-site protective action measures.

(3) Uranium Solution Release

The consequences of an off-site accidental liquid release of uranium have been evaluated for NFS facilities. In these evaluations, credit was not taken for mitigating actions that would likely reduce the offsite exposure consequences; therefore, the estimated doses represent bounding values. Radiation dose and soluble uranium intakes were estimated for worst-case postulated uranium solution releases for the maximally exposed individual (MEI) off-site member of the public. Although both ingestion and inhalation pathways were evaluated, the dose from the inhalation pathway was determined to be more bounding in all cases. Dose from the external exposure pathway would contribute an insignificant amount to the TEDE of the MEI off-site member of the public. Details of the bounding scenarios and dose consequences are provided in **Table 1C**, Postulated Accident Summary for Liquid Radiological Release.

With respect to radiation dose, the maximum offsite exposure was determined to occur for an unmitigated spill resulting from a break in the low enriched uranyl nitrate transfer line between Bldgs. 333 (BPF) and 510 (UNB). The radiation dose (TEDE) for this scenario is 0.23 rem and is just below the "Alert" threshold. Consequently, there are no uranium liquid spill scenarios for which any offsite protective actions would be warranted due to radiation exposure.

With respect to soluble uranium toxicity, the maximum exposure was determined to occur for an unmitigated spill from the tanker truck used to transport natural uranyl nitrate solutions. Assuming the truck was filled at capacity (3,700 gallons) and all the solution spilled (unmitigated), then the uranium intake for this scenario is projected to be 30 mg uranium (by inhalation). This scenario assumes no mitigating factors occur to stop the spill and the offsite individual is located at the downwind site boundary during the spill. The projected soluble uranium mass intake at the site boundary is at a level that could result in acute effects and would therefore warrant offsite protective actions due to chemical toxicity concerns.

(4) Major Fire

A major fire is defined as a fire, which cannot be reasonably controlled by local personnel and equipment, and/or, may impair radiological and chemical safety. The occurrence of a major fire at the NFS facility, which could result in a significant radiological and chemical release to the environment, is highly unlikely. All processing facilities are rated non-combustible. Combustible materials are restricted and electrical and heating equipment are carefully maintained. Automatic fire suppression systems are used in areas with high fire potential.

Offsite dose consequences have been evaluated for postulated major fire scenarios at NFS facilities. Details of the bounding scenarios and dose consequences are provided in **Table 1D**, Postulated Accident Summary for Fire. The maximally exposed receptor is 200 meters from Building 306. A 302/303 roof fire could result from a spill and subsequent ignition of flammable liquids. A Building 302/303 roof fire could affect materials in the buildings resulting in worst-case radiological doses of: CEDE of 0.55 rem and CDE to the lung of 4.5 rem (see **Table 1D**). There would be no acute health effect as a result of an airborne release of this nature.

With respect to soluble uranium toxicity, the maximum exposure was determined to occur for a fire scenario involving the UNB. The maximally exposed receptor is 10 meters downwind from Building 510. Assuming the UNB is filled to capacity and all the material is affected by the fire, the uranium intake for this scenario is projected to be 8.8 mg by inhalation. There would be no acute health effects as a result of an airborne release of this nature.

(5) Natural Phenomena

The occurrence of a catastrophic natural phenomenon could result in any of the previously described on-site accidents (i.e., nuclear criticality, UF_6 release, UN release, major fire). The potential consequences would be of similar severity as those described in the above sections (see **Table 1E**, Postulated Accident Summary for Natural Phenomena). The natural phenomena consisted are as follows:

- **Earthquake**

A seismic study completed in 2001 by Performance Technology, Inc. for NFS provides the following site specific seismic information.

The NFS site is located within the Southern Appalachian Tectonic Province, which extends from central Virginia to central Alabama and from the western edge of the Piedmont Province to the Cumberland Plateau Province. The Southern Tectonic Province has a moderate level of historical and recent earthquake activity. Typically, these very small earthquakes rarely exceed magnitude 4.0 on the Richter scale. Specific earthquakes are not associated with known faults near the NFS site because of low seismic activity, uncertainties locating small events, and determining their depths. There is no evidence of geologically recent fault displacements that would be associated with capable faults in the NFS site area or surrounding region. For the 1.0 E-3 annual probability of exceedance (1000 year return period), the horizontal component of ground motion at the NFS site for safe earthquake shutdown is a peak ground acceleration of 0.06 gravity. The vertical acceleration is two thirds of the horizontal or 0.04 gravity.

- **Tornado and Hurricane**

Severe storms are infrequent in the Erwin region, due to the fact that the region is east of the center of tornado activity, and too far inland to be often affected by hurricanes. Maximum sustained wind speeds measured in the region (Tri-City Airport) include fifty (50) miles per hour in 1951, and forty (40) miles per hour in 1962. Only one (1) tornado has been recorded in Unicoi County since 1950. The regional location of the NFS facilities does not pose any undue risk to the public from tornadoes or hurricanes.

- **Flood**

The NFS site is not within the 100 year floodplain of the Nolichucky River in accordance with the 2008 National Flood Insurance Map. Development and related activities over the last 30 years have changed the topography in such a way to preclude the NFS site from being within the 100 year floodplain for the river. However, the northern portion of the NFS site is depicted as being within the 100 year floodplain of Martin Creek on the 2008 National Flood Insurance Maps issued by the Federal Emergency Management Agency (FEMA). Martin Creek passes through a culvert at the CSX Railroad. In the past, the size of this culvert was inadequate during high flood waters, causing a backwash or damming effect on the NFS side of the

culvert. In 1990, the culvert was enlarged to accommodate expansion of the railroad. The modified culvert has lowered the 100 year flood elevation of Martin Creek. Additionally, a berm was constructed and is in place between the Northsite Decommissioning Area and the Protected Area containing processing facilities. However, the Tennessee Valley Authority (TVA) or FEMA has not revised the 100 year flood elevation map, which would lead to updating the Flood Insurance Map. The most significant flood in the last twenty (20) years for this area was in November 1977, which involved flooding of the Nolichucky River. This flood did not result in the flooding of any buildings on the NFS site. The radiological release potential from the NFS site due to a flood would pose no significant risk to the public.

(6) Security Emergency

Events, which have the potential for compromising the security of NFS, have been postulated. The accidents include: sabotage, area intrusion, aircraft crash, train derailment, and missile attack. NFS plant security systems are designed to preclude a breach of security containment. All security emergency control and response measures are specified in the NFS Safeguards Contingency Plan.

2.1.2.4 Environmental Releases

As discussed in the Emergency Preparedness section, NFS has engineered and administrative controls in place to prevent and mitigate environmental releases. Implementation of these plans is supported through on-going training of NFS personnel at all levels. The effectiveness of these plans, in combination with NFS' overall operating procedures is demonstrated by the low number of releases that occurred during the current license period and the short and long-term responses taken when a release occurred or threatened to occur.

Table 2 (Environmental Releases which Triggered an Outside Notification) provides information addressing environment compliance events that triggered outside notification from June 1996 through February 2007. NFS experienced eight (8) events during this period, requiring outside notification. Of these, only two events exceeded permit limits (Erwin POTW); however, neither event resulted in a violation of Federal standards. The August 3, 2000 event was caused by a non-representative sample and thus did not result in a radioactive material release. None of these events had a significant and/or lasting impact on the environment.

2.1.2.5 Safeguards

NFS provides nuclear material safeguards in accordance with the requirements set forth in 10 CFR Parts 70 and 73.

The NFS material accounting and control program includes: facility organization requirements, material control arrangements, accountability measurements, statistical controls, inventory methods, shipping and receiving procedures, material storage practices, records report requirements, and management controls.

The NFS physical security and protection program has provisions for both "fixed site" and "material in transit" and includes: (1) maintaining a trained security organization with armed guards, (2) maintaining physical barriers, and (3) maintaining security response and safeguard contingency plans.

2.1.3 Reasonable Alternatives

The alternative to not renewing the SNM-124 license will result in complete cessation of the fuel manufacturing and site decommissioning. Site decommissioning would significantly increase waste generation and also increase area unemployment. Since the production of naval fuel is critical to national defense the fuel production process would be transferred to another site. A new site location for fuel production would cause a significant environmental impact due to construction and start-up activities.

Table 1A
Summary of Potential Doses from Postulated Nuclear Criticality Scenarios

Origin of the Potential Criticality	Potential Dose Receptor Locations								
	Assembly Area[a]			Site Boundary (Maximum Exposed Individual)[b]			Nearest Resident (Maximum Exposed Individual)[b]		
	External Dose (rem)	Inhalation Dose (rem)	TEDE (rem)	External Dose (rem)	Inhalation Dose (rem)	TEDE (rem)	External Dose (rem)	Inhalation Dose (rem)	TEDE (rem)
105 Lab	0.95	0.50	1.45	0.63	0.50	1.13	0.43	0.50	0.93
301 CDL	2.04	0.82	2.86	0.53	0.43	0.96	0.43	0.47	0.90
302/303 (Fuels)	1.72	1.90	3.62	0.89	2.10	2.99	0.82	0.50	1.32
304 Decon	1.74	0.50	2.24	0.70	0.50	1.20	0.60	0.50	1.10
306E (Scrubber/Storage Racks)	1.80	0.50	2.30	0.87	0.50	1.37	0.80	0.50	1.30
306W (WD Tanks)	2.09	0.65	2.74	0.50	0.63	1.13	0.46	0.23	0.69
306 Main Vault	2.35	0.18	2.53	0.87	0.01	0.88	0.80	0.12	0.92
306 S/R Vault	1.80	0.19	1.99	0.87	0.15	1.02	0.80	0.12	0.92
310 Warehouse	1.62	15.00	16.62	0.36	0.26	0.62	0.24	2.20	2.44
311 Vault	2.35	0.18	2.53	0.87	0.01	0.88	0.78	0.12	0.90
330 (WWTF)	1.25	5.20	6.45	0.41	20.00	20.41	0.19	6.40	6.59
333 (BPF)	1.42	1.30	2.72	0.45	2.70	3.15	0.40	0.25	0.65
440 Bldg	10.79	2.00	12.79	0.38	0.46	0.84	0.32	1.40	1.72
510 (UNB)	4.42	3.60	8.02	5.89	3.80	9.69	1.08	2.20	3.28
520 (OCB)[c]	4.04	2.60	6.64	16.42	2.60	19.02	2.47	1.60	4.07
Max Values	**10.79**	**15.00**	**16.62**	**16.42**	**20.00**	**20.41**	**2.47**	**6.40**	**6.59**

[a] It was assumed that personnel would take approximately 5 minutes to reach the Assembly Area, missing the initial burst (estimated 0.5 second duration). It is assumed that 1E+18 fissions occur during the initial burst and this is subtracted from the number of total fissions for external dose only. The initial burst is included for both internal and external dose at the site boundary and the nearest resident calculations.

[b] Maximum Exposed Individual refers to those individuals in locations not shielded by the security blast wall.

[c] A 12" thick concrete wall has been included in the external dose calculation for at the assembly area. This has not been added for the Site Boundary or Nearest Resident external dose calculations.

Source: NFS Emergency Plan Rev. 13, March 2009

Table 1B

Postulated Accident Summary for UF_6

Accident Type	Accident Initiator	Assumed Subsequent Control Failures		Worst Case Dose at Site Boundary			Acute Health Effects at Site Boundary*	
		Engineering	Administrative	Radioactivity (rem)	Toxicity		Radioactivity	Toxicity
					U (mg)	HF (ppm)		
Airborne Radiological Release (24.9 kg UF_6) (ground release)	- A fire occurs with the ignition of combustibles located within 1.5 m (5.0 ft) from an enclosure containing a UF_6 cylinder. The fire ignites the box and engulfs the cylinder. The increased pressure ruptures the cylinder releasing UF_6 into the room.	-Heating system temperature failure; -Overpressurization of piping systems	Less than adequate procedures and/or training; -Less than adequate maintenance	0.38	0.88	0.4	No immediate effect	No immediate effect

NOTE:* EPA threshold for acute health effects in adults is fifty (50) rem (Manual of Protective Action Guides and Protective Actions for Nuclear Incidents, EPA, May 1992)

Source: NFS Emergency Plan, Rev. 13, March 2009

Table 1C

Postulated Accident Summary for Liquid Radiological Release

Origin of the Uranium Solution Rel.		Accident Initiator	Assumed Subsequent Control Failures		Worst Case Dose at Site Boundary			Acute Health Effects at Site Boundary*	
			Engineering	Administrative	Radioactivity (rem)	Toxicity		Radioactivity	Toxicity
						U (mg)	HF (mg/m^3)		
333 (BPF)	3.6E6 gU (LEUN)	-Integrity failure(s) of LEUN solution transfer line to UNB -Human errors (damage to LEUN transfer line to UNB)	-Failure of transfer line and containment piping	-Less than adequate procedures and training -Human error -Less than adequate spill containment	0.23 (CEDE) (inhalation)	9.7 (inhalation)	NA	No immediate effect	No immediate effect
510 (UNB)	4.5E6 gU (LEUN)	-Integrity failure(s) of LEUN solution transfer line to OCB -Human errors (damage to LEUN transfer line to OCB)	-Failure of transfer line and containment piping	-Less than adequate procedures and training -Human error -Less than adequate spill containment	0.19 (CEDE) (inhalation)	8.3 (inhalation)	NA	No immediate effect	No immediate effect
NUN Tanker	6.3E6 gU (NUN)	-Integrity failure(s) of NUN solution containment vessels -Human errors (NUN Tanker overflows)	-Failure of NUN Tanker containment	-Less than adequate procedures and training -Human error -Less than adequate spill containment	0.04 (CEDE) (inhalation)	30 (inhalation)	NA	No immediate effect	Possible renal (kidney) damage
520 (OCB)	8.5E5 gU (NUN)	-Integrity failure(s) of NUN solution transfer line to UNB -Human errors (damage to NUN transfer line to UNB)	-Failure of transfer line and containment piping	-Less than adequate procedures and training -Human error -Less than adequate spill containment	0.002 (CEDE) (inhalation)	1.6 (inhalation)	NA	No immediate effect	No immediate effect
440	3.5E6 gU (LEUN)	-Integrity failure(s) of LEUN solution transfer line to 440 Building -Human errors (damage to LEUN transfer line to 440 Building)	Failure transfer line and contaminant piping	-Less than adequate procedures and training -Human error -Less than adequate spill containment	0.06 (CEDE) (inhalation)	2.6 (inhalation)	NA	No immediate side effect	No immediate side effect
310 Warehouse	4 55-gallon drums	-Integrity failure(s) of solution containment vessels -Human errors (impact accident)	-Failure of solution containment vessels	-Less than adequate procedures and training -Human error -Less than adequate spill containment	0.02 (CEDE) (inhalation)	0.2 (inhalation)	NA	No immediate effect	No immediate effect

Table 1C
Postulated Accident Summary for Liquid Radiological Release

Origin of the Uranium Solution Rel.		Accident Initiator	Assumed Subsequent Control Failures		Worst Case Dose at Site Boundary			Acute Health Effects at Site Boundary*	
			Engineering	Administrative	Radioactivity (rem)	Toxicity		Radioactivity	Toxicity
						U (mg)	HF (mg/m^3)		
330 WWTF	2.9E3 gU (HEU)	-Integrity failure(s) of solution containment vessels -Human errors	-Failure of solution containment vessels	-Less than adequate procedures and training -Human error -Less than adequate spill containment	0.0004 (CEDE) inhalation	0.002 inhalation	NA	No immediate effect	No immediate effect
110/131	Possession Limit	-Integrity failure(s) of solution containment vessels -Human errors	-Failure of solution containment vessels	-Less than adequate procedures and training -Human error -Less than adequate spill containment	0.002 (CEDE) inhalation	0.06 inhalation	NA	No immediate effect	No immediate effect

NOTE:* EPA threshold for acute health effects in adults is fifty (50) rem (Manual of Protective Action Guides and Protective Actions for Nuclear Incidents, EPA, May 1992).

Source: NFS Emergency Plan, Rev. 13, Mar. 2009

Table 1D
Postulated Accident Summary for Fire

Accident Type	Accident Initiator	Assumed Subsequent Control Failures		Worst Case Dose at Site Boundary			Acute Health Effects at Site Boundary*	
		Engineering	Administrative	Radioactivity (rem)	Toxicity		Radioactivity	Toxicity
					U (mg)	HF (mg/m^3)		
Major Fire (300 Complex)	- Electrical fault; - Ignition of combustible materials; - Equipment malfunction; - Chemical reactions; - Human error	- Faulty electrical installation; - Less than adequate combustible and flammable gas equipment construction; - Failure of explosive range metering devices; - Failure of smoke detection devices and fixed fire suppression equipment	- Less than adequate procedures and/or training; - Improper use of ignition sources and combustible materials; - Incorrect storage of combustible wastes; - Less than adequate preventative maintenance program; - Incorrect use of chemicals; - Less than adequate inspections and audits; - Incorrect permitting of work involving ignition sources	- 300 Complex: 0.55 rem. (CEDE), 4.5 (CDE - Lung)	0.04	NA	No immediate effect	No immediate effect
UNB				0.2 rem	8.8 mg	NA	No immediate effect	No immediate effect
OCB				0.04 rem	0.5 mg	NA	No immediate effect	No immediate effect
BPF MAA				0.08 rem	0.2 mg	NA	No immediate effect	No immediate effect
BPF LEU Area				0.02 rem	1.3 mg	NA	No immediate effect	No immediate effect
440				0.003	0.135 mg	NA	No immediate effect	No immediate effect

Note: * EPA threshold for acute health effects in adults is fifty (50) rem (Manual of Protective Action Guides and Protective Actions for Nuclear Incidents, EPA, May 1992)
Source: NFS Emergency Plan, Rev. 13, Mar. 2009

Table 1E
Postulated Accident Summary for Natural Phenomena

Accident Type	Accident Initiator	Assumed Subsequent Control Failures		Worst Case Dose at Site Boundary			Acute Health Effects at Site Boundary*	
		Engineering	Administrative	Radioactivity (rem)	Toxicity		Radioactivity	Toxicity
					U (mg)	HF (mg/m^3)		
Natural Phenomena (earthquake, tornado, hurricane, and flood)	- Act of God	- Less than adequate building code standards	- Less than adequate emergency preparedness	- Reference worst case dose for nuclear criticality accident.	- Reference worst case dose for a uranium solution release.	- Reference worst case dose for a UF_6 release.	Reference effects associated with worst case radiation dose.	Reference effects associated with worst case toxicity.

Note: * EPA threshold for acute health effects in adults is fifty (50) rem (Manual of Protective Action Guides and Protective Actions for Nuclear Incidents, EPA, May 1992)

Source: NFS Emergency Plan, Rev. 13, Mar. 2009

Table 2

Environmental Releases Which Triggered an Outside Notification

Date	Event	Agency Notified	NFS Response
8/29/97	Ground Water leak during transfer to WWTF	TDEC NRC	Line leak was caused by weight of a large rock on the discharge line. The line was repaired.
9/4/98	Sewer discharge to Erwin POTW exceeded Gross Beta limits of 300 pCi/l.	Erwin Utilities NRC	A sanitary sewer manhole near a building being decommissioned was determined to be the cause. The line was capped and filled with concrete. The action was effective.
5/12/99	Sewer discharge to Erwin POTW exceeded 25 pCi/l for ^{238}U	Erwin Utilities NRC	The cause was determined to be a leak in a laboratory sump and adjacent manhole. The items were repaired.
8/3/00	The May 2000 monthly isotopic composite sample result for WWTF discharges was elevated.	NRC	Terminated WWTF discharges. Investigated cause and validity of sample results. The composite sample was not representative. Procedures and training were modified to address the issue.
8/8/00	Groundwater infiltration caused an overflow of lab waste water pit	TDEC NRC	Sealed the sump to prevent ground water infiltration
11/29/00	A defect in the floor trench of the WWTF was identified during an inspection	TDEC	Repaired defects
9/22/03	The WWTF discharged a batch with elevated nitrite plus nitrate attributes	TDEC	Reinstruction of operation
2/05 & 3/05	Sewer discharge to the EPOTW exceeded the Technical Review Criteria and the monthly Average permit limit for U-238 in March 05.	EPOTW NRC	Plugged abandoned sanitary sewer line.

Source: Various NFS notifications to outside agencies.

Figure 3A

Liquid Effluent Discharge Points

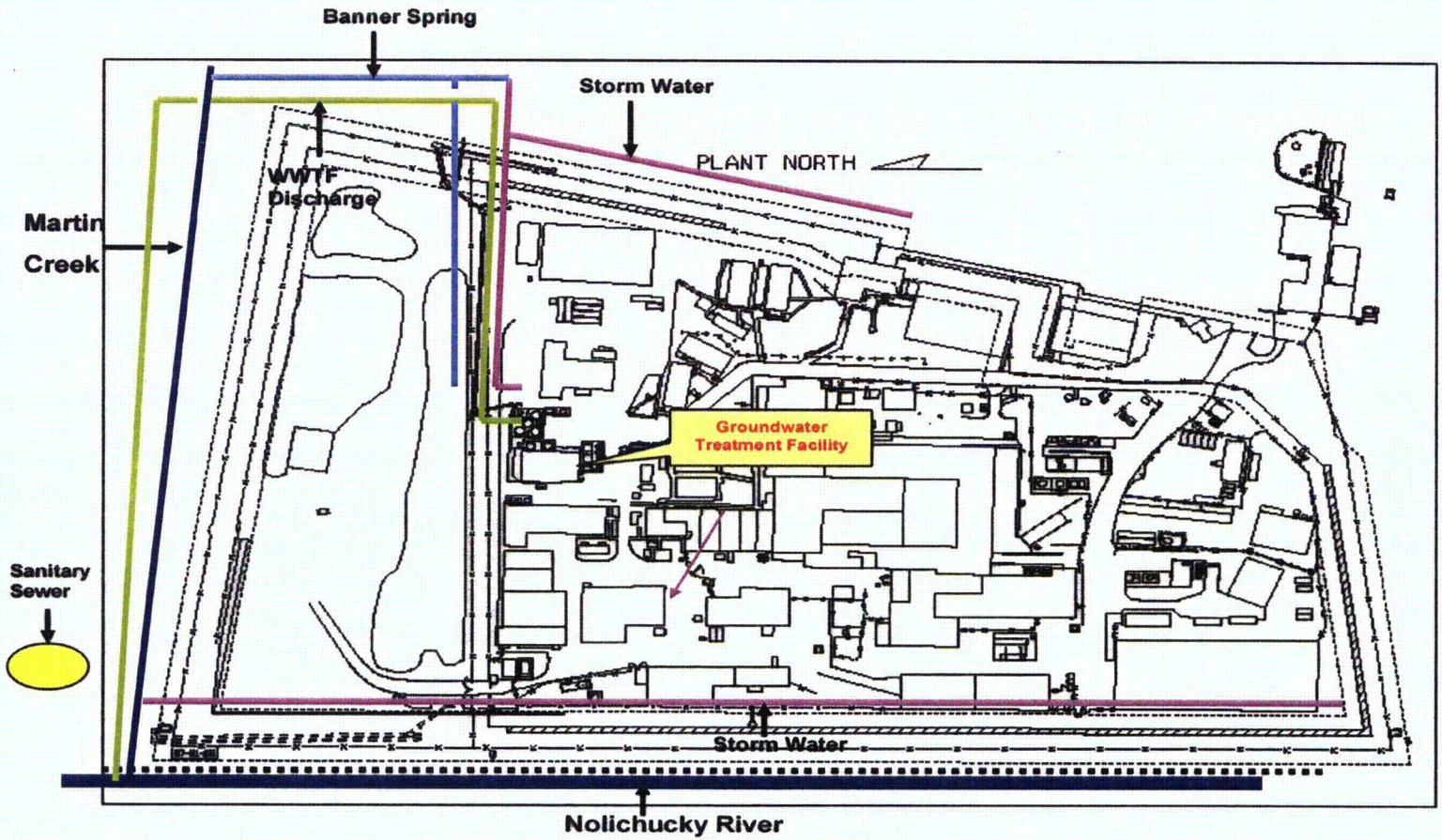


Figure 3B
BLEU Liquid Effluent
Discharge Points

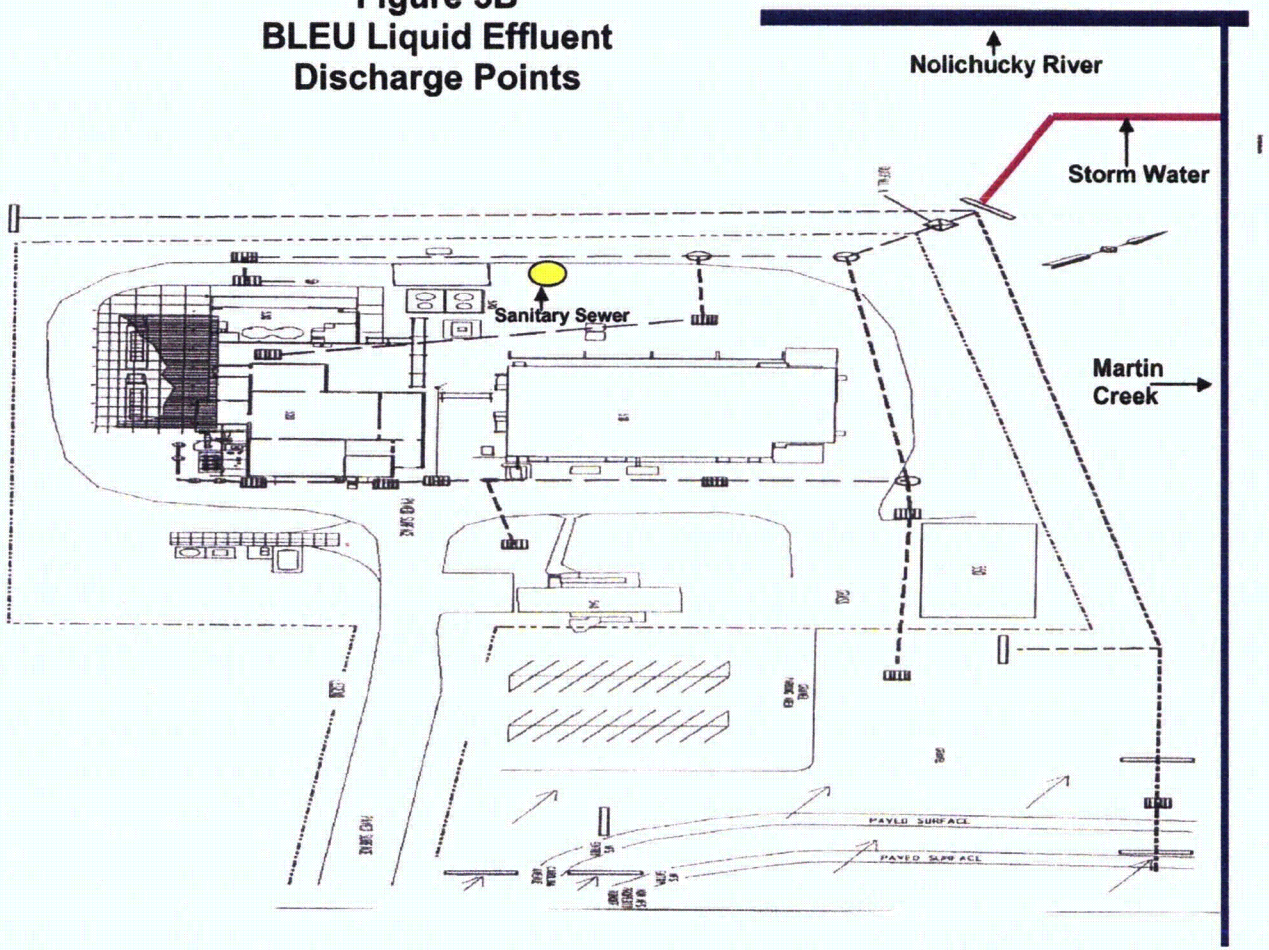
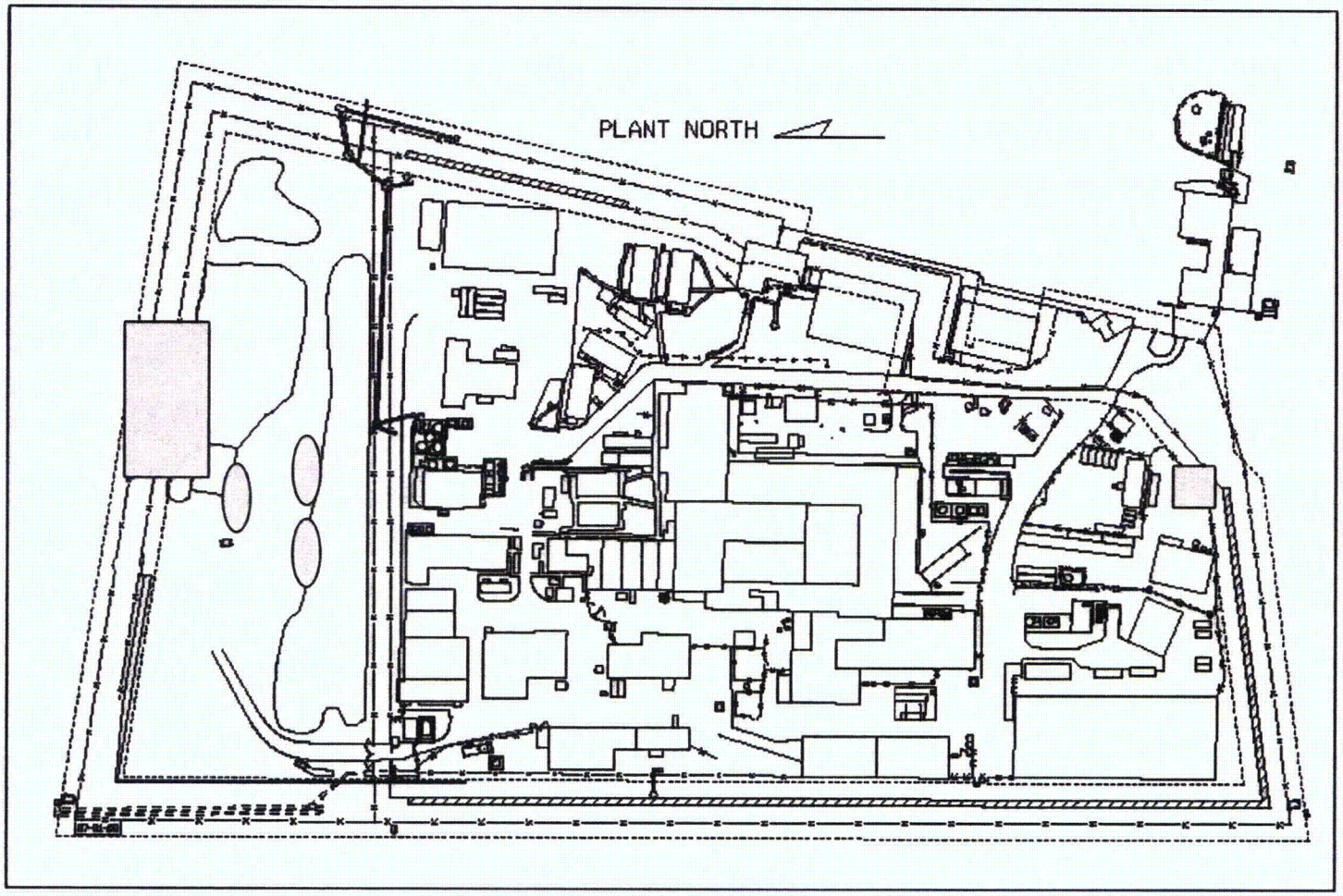


Figure 4
Former Waste Disposal & Storage Area



3.0 Description of the Affected Environment

3.1 Land Use

The NFS Plant utilizes about 66.2 percent of the 69.9 acre site area for licensed activities. **Table 3** (NFS Site Land Use) provides a breakdown of the land use by size and percent of total site area.

Table 3

NFS Site Land Use

Use	*Size (acres)*	*Percent of Site*
Buildings and grounds	34.7	49.6
Former waste ponds and solid waste burial grounds	11.6	16.6
Parking lot	9.6	13.8
Open fields	3.5	5.0
Woods, brush and shrub swamp	10.5	15.0
Total	69.9	100

Source: NFS Drafting Dept. 2007

3.1.1 Adjacent Areas

The land use within a one mile radius of NFS is dominated mainly by residential use. **Table 4** (Land Use within a 1 Mile Radius of NFS) provides a breakdown of the percent land use within this area.

Table 4

Land Use within a 1 Mile Radius of NFS

Use	*Percent of Area*
Residential	91.4
Commercial	5.9
Industrial	1.6
Farms, suburban homes	0.8
Mountainous forest	0.2
Total	**100**

Source: Erwin TN Register of Deeds, 5/22/08

Locally important crops include tobacco, hay, corn, tomatoes, and strawberries. Beef, swine and dairy production is low. Residential gardens are common, and include summer squash, green beans, tomatoes, okra, sweet corn, and potatoes.

3.1.2 Flood Plain, Stream and Marshes

The NFS site is not within the 100 year flood plain of the Nolichucky River. Development and related activities over the last 30 years have changed the topography in such a way so as to preclude the NFS site from being within the 100 year flood plain for the river. For example, the construction of US Routes 19/23, and the re-channeling/increase in depth of the river, which accompanied the highway construction combined with the re-routing of Martin Creek to enter the Nolichucky River downstream of the NFS site, have had the indirect effect of protecting the NFS site from a 100 year flood of the Nolichucky River. A significant flood of the Nolichucky River (92% of greatest recorded flow) which occurred in 1977 did not result in the flooding of any building on the NFS site.

Currently, the northern portion of the NFS site is depicted as being within the 100 year flood plain of the Martin Creek (which flows adjacent to the northern boundary) on 2008 National Flood Insurance Maps issued by the Federal Emergency Management Agency (FEMA). Martin Creek passes through a culvert at the CSX Railroad to the north of the NFS site. In the past, the size of this culvert was inadequate during high flow floods, causing a backwater or damming effect on the northern portion of the NFS site nearest the culvert. In 1990, the culvert was enlarged to accommodate expansion of the railroad. The modified culvert has lowered the 100 year flood elevation of Martin Creek. FEMA updated the Flood Insurance Map (September 3, 2008) for the city of Erwin, however the modified culvert is not shown. The map still depicts NFS within the 100 year flood plain of Martin Creek.

Streams on-site are Banner Spring Branch and Martin Creek. Banner Spring Branch is entirely contained inside an underground enclosed pipe on the NFS site. Two (2) small wetland areas are located on the north side of the site. The wetland areas are approximately 0.66 acres in size.

3.2 Transportation

The NFS Erwin Plant is located in the City of Erwin, in Unicoi County, which is in the northeastern portion of the State of Tennessee (**Figure 1**, NFS Site Location). The facility is accessed by US Highway 26 and a CSX Railroad line on the northwest boundary and Banner Hill Road on the southeast boundary.

3.3 Geology and Soils

3.3.1 Physiography and Geography

The NFS site lies in the Valley and Ridge physiographic province of northeastern Tennessee. The stratigraphy of the area is very complex because much folding and faulting has occurred. The topography consists of a series of alternating valleys and ridges that have a northeast-southeast trend, with NFS occupying a valley (DOE 1996d).

Three dolomite formations underlie the valley: the Shady, Knox, and Honaker Formations. They are associated with a large band of sandstone, siltstone, shale, dolomite, and limestone called the Rome Formation. Large areas of these formations are covered by deep soils found in the colluvium from the adjacent mountains and alluvium from larger streams. The present topography of the valleys is the result of stream erosion of softer shale's and limestones; the ridges are underlain by the more resistant shale, sandstone, and quartzite. Metamorphic and intrusive rocks of the Blue Ridge physiographic province lie southwest and southeast of NFS (DOE 1996d).

3.3.2 Foundation Geology

The bedrock strata at the NFS site are consolidated, providing firm foundations for buildings that lie directly on the strata or that are supported by footings. Structures that are constructed on the unconsolidated alluvium from the former flood plain and terraces of the Nolichucky River are subject to settlement during the first 2 to 3 years after construction (NRC 1991).

The NFS site is not likely to experience slope failure. Such failures are common in the mountainous terrain surrounding the site, but not on the former flood plain where slopes are flat. Structures are set back sufficiently from the Nolichucky River to avoid destabilization by erosion or slope failures along the river bank (NRC 1991).

3.3.3 Mineral Resources

The principal mineral resources of Unicoi County are sand and gravel used by the construction industry, and metallurgical grade manganese, and iron ore (NRC 1991d). Extraction of sand and gravel from the bed and flood plain of the Nolichucky River and North Indian Creek began in the 1940s and was more or less continuous until the mid-1970s when large-scale operations ceased. Manganese deposits are contained mostly in the clay rich residual soils of the Shady Dolomite. Manganese is also found in residual soils of the Honaker Dolomite and lower portions of the Rome Formation. Manganese mines began producing near the end of World War II. Many manganese deposits in the area remain untapped. Small iron ore deposits were mined before World War I, but the industry was unable to sustain itself.

3.3.4 Seismicity

NFS lies in the moderately active Appalachian Tectonic Belt, which is located in Seismic Zone 2, indicating that moderate damage could occur as a result of earthquakes. The NFS site is cut by many inactive faults formed during the late Paleozoic Era. There is no evidence of capable faults (as defined by 10 CFR Part 100) in the immediate area of NFS. The nearest capable faults are located 62.1 miles southwest and 124 miles northeast of the site. Strong earthquakes originating in more active regions southwest of the site have been felt in eastern Tennessee, but no damage has been experienced at the site (DOE 1996). A maximum horizontal ground surface acceleration of 0.18 gravity at NFS is estimated to result from an earthquake that could occur once every 2,000 years. The facilities at NFS that are utilized for processing significant quantities of radioactivity

were designed to withstand an earthquake with an acceleration of 0.18 gravity (NFS 1996b and 2007 ISA Summary Report).

3.4 Water Resources

3.4.1 Surface Water

There are four major surface water bodies in the vicinity of NFS' Erwin Plant: Banner Spring Branch, North Indian Creek, Martin Creek, and the Nolichucky River. Banner Spring Branch is located entirely within the site enclosed inside an underground pipe. North Indian Creek is located north of the site boundary; Martin Creek is just beyond the site's north boundary; and the Nolichucky River is located west of the site boundary (**Figure 5**, Surface Water Bodies in the Vicinity of NFS).

In 2005, Banner Spring Branch was enclosed inside an underground pipe to prevent contamination, during decommissioning activities. It is a small spring-fed stream that flows in an eastly direction at a rate of approximately 0.35 to 0.71 ft^3/s. It empties into Martin Creek at the site boundary. The Banner Spring stream is approximately 1,700 feet in length from source to confluence with Martin Creek. Banner Spring Branch receives input from NFS site surface water run-off.

Martin Creek is fed from mountain springs, rain, and snow melt drainage from Martin Creek Hollow. The flow of the creek varies seasonally from 2.11 to 11.0 ft^3/s. Martin Creek empties into North Indian Creek approximately 3,500 feet north of the NFS site, and North Indian Creek empties into the Nolichucky River approximately 4,000 feet downstream of the site.

The Nolichucky River is formed by the North Toe River and the Cane River in Yancey and Mitchell Counties. The river flows west from North Carolina and southwest through Tennessee to join the French Broad River, whose watershed forms part of the upper Tennessee River Basin. The average flow of the river at a point near the NFS site is approximately 1,380 ft^3/s.

The 81-year average flow of the Nolichucky River is 1,222 ft^3/s as measured at the Embreeville USGS gauge station located approximately 2.2 miles (mile 96.8) down stream of the NFS National Pollutant Discharge Elimination System (NPDES) permitted WWTF Outfall 001. The highest peak flow since May of 1901 was on November 6, 1977, when the Nolichucky River reached a gage height of 21.52 feet with a flow velocity of 110,000 ft^3/s. The lowest annual mean stream flow recorded at the Embreeville gage station in the last 30 years was 657 ft^3/s in 1988. A thirty-year low annual river flow at Outfall 001 was calculated to be 589 ft^3/s (16.7 m^3/s) (NFS 2001d).

3.4.1.1 Quality

The streams and creeks of Tennessee are classified by the Tennessee Department of Environment and Conservation (TDEC). The classifications are defined in the State of Tennessee Water Quality Standards. Classifications are based on water quality,

designated uses, and resident aquatic biota. Banner Spring Branch, Martin Creek, and the Nolichucky River are all classified for fish and aquatic life, livestock watering and wildlife, irrigation, and recreation. The Nolichucky River is also classified for industrial use and as a domestic water supply.

NFS has three outfalls covered by NPDES permits. One outfall carries process-related effluents while the two others carry (covered by separate permits) storm water. In addition, NFS discharges sanitary waste water, treated groundwater (NFS), and treated process effluent (NFS/AREVA) to the Erwin Publicly Owned Treatment Works (POTW) in accordance with Industrial Pretreatment Permits (013 and 019) issued by Erwin Utilities. **Table 5** gives the approximate discharge volumes and, where applicable, the volume allowed to be discharged under each permit.

Table 5

NFS Permitted Outfalls

Outfall	*Typical Output (gal/yr)*	*Permitted Volume (gal/yr)*	*Discharge Location*
Waste water Treatment Facility (NFS)	5,000,000	N/A	Nolichucky River (TN0002038)
Storm water (NFS)	N/A	N/A	Banner Spring Branch & Martin Creek (TNR050873)
Storm water (NFS/AREVA)			Martin Creek (TNR056583)
Sanitary Sewer (NFS)	53,000,000	N/A	Erwin POTW (013)
Sanitary Sewer (NFS/AREVA)			Erwin POTW (019)

Source: NFS EDMS

The ambient non-radiological water quality characteristics are summarized in **Table 6** (Non-Radiological Surface Water Quality). Non-radiological characteristics for Banner Spring Branch, Marin Creek, and the Nolichucky River are not routinely measured; however, 2002 chemical data is presented in **Table 6**. The results are typical for the area. Martin Creek water quality is likely to be affected by the Creek's passage through the Erwin Fish Hatchery located approximately 600 feet upstream from NFS.

Table 6
Non-Radiological Surface Water Quality

Parameter	Water Quality Benchmark[a] (mg/l)	Nolichucky River[c] (mg/l)	Banner Spring Branch[c] (mg/l)	Martin Creek[c] (mg/l)
Ammonia	N/A	<0.36	<0.333	<0.331
Fluoride	4[d]	0.417	0.387	0.303
Mercury	0.002[e]	<0.0002	<0.0002	<0.0002
Nitrate/Nitrite	10[d]	0.424	1.821	1.059

NOTE:
a: For comparison only, unless noted referenced value is from applicable TDEC water quality criteria and standard
b: Data from 2002 water samples downstream if NFS discharge
c: National Secondary Drinking Water Standard (40 CFR Part 141)
d: National Primary Drinking Water Standard (40 CFR Part 143)
e: Tennessee State Water Quality Standards

3.4.1.2 Use

Banner Spring Branch and its source, Banner Hill Spring, are located entirely on the NFS site within the Protected Area. The Branch receives discharges from two NFS storm water outfalls. Banner Spring Branch is completely enclosed inside a pipe and discharges into Martin Creek on the northside of the NFS site.

The main portion of Martin Creek, which is upstream of NFS, is used for recreational fishing. Fishing in the portion of Martin Creek near the NFS site is infrequent due to limited access. About 600 feet upstream from NFS is a State-operated fish hatchery located on Love Spring Branch, a tributary to Martin Creek. The hatchery requires over 1 million gallons per day to operate. The creek is not classified as a trout stream by the State of Tennessee, nor is it used as a potable water source. It is, however, classified for fishing, recreation, irrigation, livestock watering, and wildlife use.

The Nolichucky River in the vicinity of the NFS outfall is classified for domestic water supply, industrial, fishing, recreation, irrigation, livestock watering, and wildlife use. The City of Jonesborough is the nearest municipal user of the water as a source of drinking water (approximately 1 million gallons/day). The City of Jonesborough Treatment Plant's water intake is approximately 8 miles downstream from the NFS discharge point. The closest known crop irrigation use of river water occurs over 10 miles downstream of the NFS discharge. Irrigation is rare due to the adequacy of rainfall in this area for crop production. Irrigation is primarily used in the spring and fall to reduce crop damage from frost (e.g., strawberries and tomatoes) and to extend the growing season and preserve the quality of tomato crops. Recreational use of the Nolichucky River includes fishing (bass, walleye, and catfish), boating (canoeing/rafting), swimming, and picnicking. The Erwin Utilities POTW discharges into the same reach of the Nolichucky River, as does NFS.

3.4.2 Groundwater

3.4.2.1 Quality

The groundwater quality in the area is generally good. The principal dissolved constituents of the groundwater are calcium, magnesium carbonate, and bicarbonate, regardless of the production zone geology. This reflects the regional influence of dolomitic host rocks on groundwater quality.

Data on the ambient non-radiological water quality is summarized in **Table 7** (Ambient Non-Radiological Groundwater Quality). Ambient non-radiological characteristics for groundwater are assessed routinely by measurements of an up-gradient well (NFS well #52).

Table 7

Ambient Non-Radiological Groundwater Quality

Parameter	*Unit*	*Water Quality Benchmark* [a]	*Up-gradient Well* [b]
Chloride	mg/l	250[d]	3.256
Fluoride	mg/l	4[c]	0.051
Mercury	mg/l	0.002[e]	0.0001
Sulfate	mg/l	250[d]	11.560
Tetrachloroethylene (PCE)	mg/l	0.005[c]	0.011
Temperature	°C	N/A	14.44
Total organic carbon	mg/l	N/A	3.56

[a] *For comparison only*
[b] *Average of available data for well #52from June 1996 through 2008. Nitrate/Nitrite and Phosphate were not collected during this time period.*
[c] *National Primary Drinking Water Standards (40 CFR Part 141)*
[d] *National Secondary Drinking Water Standards (40 CFR Part 143)*
[e] *Tennessee State Water Quality Standards*

3.4.2.2 Use

Groundwater elevation measurements and modeling indicate that, generally, groundwater flows in a northwest direction towards the Nolichucky River, which is a major discharge zone for the groundwater flowing beneath the NFS site. There are no known household, public, or industrial users of groundwater down gradient of the site (GMI 1996).

Most drinking water sources are provided by the local municipality; however, wells and springs are an important source of water supply for individuals and several communities in the area (Erwin and Chestoa quadrangles). A water-well survey has been performed for the NFS facility consisting of a Tennessee Department of Environment and Conservation (TDEC) - Division of Water Supply database records search for the surrounding area (Erwin and Chestoa quadrangles). The TDEC records are the most comprehensive water well survey in Tennessee, are traceable to individual users, and

provide sufficient information to evaluate well installation practices. The state of Tennessee requires domestic wells to be cased and to be developed in the most favorable water quality source available. Review of the TDEC records indicate that domestic wells are cased and installed in bedrock formations to tap water present in the deeper portions of the aquifer.

A portion of the well search consisted of determining water wells located within a 1-mile radius and public water systems located within a 3-mile radius of the NFS facility. One public water system well was listed on the Public Water Systems database for Unicoi County within 1 mile from the NFS facility (**Table 8**, Public Water Systems Database Search within 1 Mile of NFS Facility). The groundwater well, approximately 0.75 miles northeast (up gradient) of the NFS facility, is owned by Erwin Utilities and is listed as the Railroad Well. Modeling done in 1996 indicated that groundwater withdrawn from the Railroad Well does not originate beneath or down-gradient from the NFS site (GMI 1996). No other wells were identified from the database within 1 mile from the NFS facility.

Table 8

Public Water Systems Database Search within 1 Mile of NFS Facility

Name	*Source*	*Water Source Type*
Erwin Utilities	Railroad Well	Groundwater

Source: Tennessee Department of Environment and Conservation - Division of Water Supply Records of Water Wells on the Erwin and Chestoa Quadrangles.

Four public water intakes within a 3-mile radius of the NFS facility were listed on the Public Water Systems database for Unicoi and Washington Counties (**Table 9**, Public Water Systems Database Search Within 3 Miles of NFS Facility). The four public water intakes are listed as a groundwater source or groundwater under the direct influence of surface water source. Erwin Utilities obtains water from two wells (one of which is the Railroad Well) and one spring located northeast of the NFS facility. USA Raft, Inc. and Nolichucky Gorge Campground obtain water from a spring south of the NFS facility.

Table 9

Public Water Systems Database Search within 3 Miles of NFS Facility

Name	*Source*	*Water Source Type*
Erwin Utilities	Birchfield Well	GUDI
Erwin Utilities	O'Brien Spring	GUDI
Erwin Utilities	Railroad Well	Groundwater
Nolichucky Gorge Campground	Spring (Private)	Groundwater
USA Raft Inc.	Spring (Private)	Groundwater

Source: Tennessee Department of Environment and Conservation Division of Water Supply Records of Water Wells on the Erwin and Chestoa Quadrangles.

3.5 Ecological Resources

3.5.1 Terrestrial Biota

Plant communities at NFS are characteristic of the intermountain regions of central and southern Appalachia. Major forest types in the Erwin area are oak-hickory, oak-pine, and white pine (NRC 1991e). Valley floors, mountains, and mountain coves have their individual characteristic vegetation types. The natural vegetation in the vicinity of the NFS site is a forest community dominated by red or white oak with subdominants including yellow poplar, hickories, other oaks, and some southern pine species (NRC 1991f).

The NFS site lies within Indian Creek Valley. Plant communities in this valley consist of second growth forests and open grassy areas. Most of the NFS site is occupied by buildings, building grounds, and open fields. Limited areas consist of woods, shrub swamp, and brush. Nearby mountainous areas are largely undisturbed and support extensive forests and wildlife resources (NRC 1991).

The terrestrial fauna of the Erwin region includes a large number of vertebrate species including 70 mammals (NRC 1991g), 140 birds (NRC 1991h), 35 reptiles, and 34 amphibians; however, most of these species would not be expected to occur in the Indian Creek Valley because of extensive disturbance and lack of natural habitats. Eastern cottontails, mourning doves, and northern bobwhites are present in most areas within the Indian Creek Valley (NRC 1991). The woods, swamps, and brushy areas onsite or in the vicinity are likely to support some smaller wildlife species. Common species in the region include European starling, northern cardinal, mourning dove, Carolina chickadee, opossum, eastern cottontail rabbit, and house mouse. Important game species of the region include whitetail deer, eastern gray squirrel, ruffed grouse, and wild turkey, which occur in the forests of the surrounding mountains but are not common onsite. Carnivores, such as the gray fox, and raptors, such as the red-tailed hawk, are ecologically important groups in the vicinity of the Plant (DOE 1996).

3.5.2 Aquatic Biota

Aquatic habitat on or adjacent to NFS ranges from the Nolichucky River to several small streams. Banner Spring Branch contains several species of minnows where it converges with Martin Creek. Martin Creek is typical of creeks in eastern Tennessee. The stream bed is composed of sand, pebbles, rocks, and some organic matter. A state-operated fish hatchery is located on a tributary to Martin Creek approximately 600 feet upstream of NFS. The Nolichucky River in the Erwin vicinity contains a substrate of rocks, sand, boulders, and some aquatic moss. Riffles and large pools provide good smallmouth bass habitat. Other fish species present in the Nolichucky River include olive darters, catfish, largemouth bass and spotted bass, central stonerollers, and white crappie (DOE 1996).

3.5.3 Threatened and Endangered Species

Thirteen Federal and State listed threatened and endangered species that potentially occur in the region are presented in **Table 10** (Federal and State Listed Threatened and Endangered Species). No Federal-listed threatened or endangered species are known to occur onsite. In addition, no Federal-listed aquatic species are known to reside in the Nolichucky River, or other surface waters in the immediate vicinity or downstream of NFS (NRC 1991). Several plant species considered threatened (i.e., species of plant which the State has deemed likely to become endangered within the foreseeable future throughout all or a significant portion of its range in Tennessee) have been recorded in the vicinity of NFS. Threatened plants are not afforded legal protection unless located on TDEC lands.

Table 10

Federal and State Listed Threatened and Endangered Species

Common Name	*Scientific Name*	*Status*	
		Federal:	*State*
Eastern cougar	*Felis concolor couguar*	E	E
Gray bat	*Myotis grisescens*	E	E
Indiana bat	*Myotis sodalis*	E	E
River otter	*Lutra canadensis*	NL	T
Appalachian Bewick's wren	*Thryomanes bewickii altus*	NL	T
Bald eagle	*Haliaeetus leucocephalus*	T	T
Common raven	*Corvus corax*	NL	T
Golden eagle	*Aquila chrysaetos*	NL	T
Osprey	*Pandion haliaetus*	NL	T
Peregrine falcon	*Falcon peregrinus*	E/SA	E
Red-cockaded woodpecker	*Picoides borealis*	E	E
Northern pine snake	*Pituophis melanoleucus melonoleucus*	NL	T
Tennessee cave salamander	*Gyrinophilus palleucus*	NL	T

[a] *Status codes: E = endangered; NL = not listed; T = threatened, E/SA = Endangered by similar appearance*

Source: 50 CFR Part 17.11; NRC 1991; DEC 1996

3.6 Meteorology, Climatology, and Air Quality

3.6.1 Meterology

The average annual precipitation in the Erwin area is 54.0 inches. The average annual snowfall in the Erwin area is 15 inches (Erwin 2003). Prevailing winds tend to follow the southwest to northeast orientation of the valley with a 30 year average wind speed of 6.9 mph (TRI 1996).

3.6.1.1 Winds, Tornadoes and Storms

Severe storm conditions are rare in the Erwin region, which is east of the center of tornado activity, south of most blizzard conditions, and too far inland to be affected by hurricanes (NRC 1991a). Only one tornado has been recorded in Unicoi County since 1950 (NFS 1984). The tornado occurred on July 10, 1980 on the eastern end of Unicoi County approximately 6 miles from the NFS site. The tornado magnitude was an F3, with wind gusts of between 162-209 mph, twelve (12) individual injuries occurred, no deaths were reported, with property damage of 250K, and with no crop damage occurring (NOAA 2008).

3.6.2 Climatology

The climate in the vicinity of NFS is characterized by warm, humid summers and relatively mild winters. Cooler, drier weather in the area is usually associated with polar continental air masses, whereas warmer, wetter weather is associated with gulf maritime masses (NRC 1991).

The average annual 2006 temperature was 56.2°F; the average daily minimum winter temperature is 32.2°F in January; and the average daily maximum summer temperature is 87.1°F in July (NOAA 2006).

3.6.3 Air Quality

The NFS facility is located in the Eastern Tennessee-Southwestern Virginia Interstate Air Quality Control Region (AQCR). As of January 1995, the areas within this AQCR were designated as in attainment with respect to National Ambient Air Quality Standards (NAAQS), as specified in 40 CFR Part 81.343.

One Prevention of Significant Deterioration (PSD) Class I area can be found in the vicinity of NFS. This is the Great Smoky Mountains National Park, which is located approximately 47 miles southwest of NFS. Since the promulgation of the PSD regulations (40 CFR Part 52.21) in 1977, no PSD permits have been required for any emission source at NFS.

3.7 Noise

The noise environment near NFS is typical of a rural location. Major noise emission sources within NFS include various alarm systems, fixed plant equipment (e.g., pumps, blowers), and heavy equipment (tractor trailers, front-end loaders, back-hoes, etc.). The primary source of noise at the site boundary is from traffic, with other sources occasionally audible above background. During shift changes, the plant traffic may be a significant contributor to noise levels in the area. The State of Tennessee and Unicoi County have not established specific numerical environmental noise standards applicable to NFS.

3.8 Historic and Cultural Resources

No pre-historic or historic archaeological sites have been identified on the NFS site. The National Register of Historic Places (NRHP) lists three sites in the city of Erwin located in the county of Unicoi. One is the Clarksville Iron Furnace on Tennessee State Highway 107 in the Cherokee National Forest, approximately 10 miles west of NFS. The Clinchfield Depot located at the junction of Nolichucky Avenue and Union Street. The A.R. Brown house located at 241 South Main Avenue. The depot and the A.R. Brown house are both approximately 1 mile from NFS.

3.9 Visual/Scenic Resources

The view/scenic resources of the NFS site are identified in **Figure 2**. The following changes have been made to the site since the 1980's:

- Decommissioning of portions of the plant site started in the mid 1980's;
- Construction of the AREVA NP (BLEU Complex) Facility on the southwest side of the site in August 2002; and
- Security wall around the parameter of the main NFS site started in 2007.

The protection and preservation of scenic and environmental resources on the NFS site and surround community are part of all construction projects.

3.10 Demography and Socioeconomic

The NFS facility is located approximately fifty (50) miles north-northeast of Asheville, North Carolina and twenty (20) miles south of Johnson City, Tennessee. The facility is located near the northwest boundary of the City of Erwin, Tennessee, which has a population of 5,610 people (US Census 2000). Based upon the 2000 census, 4,518 people live within a one mile radius of the Plant and approximately 22,609 people live within a five (5) mile radius (UCAP 2008).

Table 11 (Tri-Cities Tennessee MSA Employment Statistics) provides employment and economic information from the Tri-Cities, Tennessee Metropolitan Statistical Area (MSA).

Table 11

Tri-Cities Tennessee MSA Employment Statistics

Regional Economic Area	*May 2001*[a]	*Dec 2006*[b]
Civilian labor force	224,800	244,120
Employment	216,600	234,090
Unemployment	8.200	10.030
Unemployment Rate	3.7	4.1

Source: [a]United States Department of Labor, Bureau of Labor ,Statistics, USDL 01-193, June 27, 2001
[b]Tennessee Department of Employment Security, Dec. 2006

Region of Interest (ROI) for the NFS site includes four Tennessee counties: Carter, Sullivan, Unicoi, and Washington. The ROI economic data for 2005 is presented in **Table 12** (2005 ROI Economic Data). For comparison, the median household income for the State of Tennessee is $38,947 and 15.6% of the population is below the poverty level.

Table 12
2005 ROI Economic Data

Location	Median Household Income	Persons Below Poverty Level
Unicoi County	34,796	15.6
Carter County	32,707	19.1
Washington County	38,411	14.4
Sullivan County	35,375	15.7

Source: US Census Bureau 2008

Table 13 (NFS Employee Distribution by Residence) represents the distribution of NFS employees among the ROI counties in April 2007.

Table 13

NFS Employee Distribution by Residence

County	*Number*	*Percent of Employment*
Carter	91	14.4
Sullivan	37	5.9
Unicoi	188	29.8
Washington	264	40.4
Total in ROI	**580**	**92.0**
Total Employees	**630**	**100**

Source: NFS NFS Department of Human Resources April 2007

Table 14 (Population Distribution and Percent Employment by NFS in Region of Interest) provides the population breakdown by county and the NFS current employment percent in each of the counties. The total population in the ROI is 341,660 (USCB 2005). NFS provides for approximately 1.47% of the regional employment. Unicoi County has the largest percentage, at 1.07%.

Table 14

Population Distribution and Percent Employment by NFS in Region of Interest

County	*Number in 2000*	*Percent Employed by NFS*
Carter	58,865	0.15
Sullivan	152,716	0.02
Unicoi	17,572	1.07
Washington	112,507	0.23
Total in ROI	**341,660**	**1.47**

Source: U.S. Census Bureau, Census 2005

Table 15 (Selected Demographic Characteristics for the NFS ROI) summarizes certain demographic characteristics for the ROI. The data was obtained from the 2005 U.S. Census Bureau.

Table 15
Selected Demographic Characteristics for the NFS ROI

Characteristics	Carter County (%)	Sullivan County (%)	Unicoi County (%)	Washington County (%)	Total ROI (%)
White	97.2	96.5	98.7	93.8	80.7
Black or African America	1.6	2.1	0.6	4.0	16.8
Hispanic or Latino (of any race)	1.2	0.8	2.7	1.8	3.0
American Indian and Alaska Native	0.2	0.2	0.3	0.3	0.3
Asian	0.3	0.5	0.0	0.0	0.1
Native Hawaiian and other Pacific Islander	0.0	0.0	0.0	0.0	0.1
Two or more races	0.7	0.6	0.4	0.9	1.0
Median household money income[b]	28,796	35,541	31,997	34,554	37,925
Total 2000 Population[a]	58,865	152,716	17,572	112,507	5,962,959

[a]Totals may add up to more than the total population (100%), because individuals may report more than one race
[b]Source: U.S. Census Bureau, Census 2005 QuickFact

3.11 Public and Occupational Health

3.11.1 Background Radiation Exposures

All residents in the vicinity of the NFS site are exposed to background radiation from a variety of natural and man-made sources. The major sources of background radiation exposure in the vicinity of NFS are shown in **Table 16** (Background Sources of Radiation Exposure).

Table 16

Background Sources of Radiation Exposure

Source	*CEDE (mrem/yr)*
Cosmic radiation	27
External terrestrial radiation	28
Internal terrestrial radiation	39
Radon in homes	200
Diagnostic X-rays and nuclear medicine	52
Weapons test fallout	<1
Air travel	1
Consumer and industrial products	10
Total	**358**

CEDE = Committed effective dose equivalent
Source: NCRP 93

3.11.2 Background Radioactivity

NFS' routine radiological surveillance program includes determining the local background level of radioactivity in media that could potentially be affected by Plant operations. **Table 17** (Alpha Background Radiation and Alpha Radioactivity in Vicinity of NFS) presents data for background monitoring locations from NFS' surveillance program.

Table 17

Alpha Background Radiation and

Alpha Radioactivity in Vicinity of NFS

Station	*Media*	*Background Level*	
Asheville Highway	Ambient air	1.66×10^{-12}	pCi/l
	Soil	22.5	pCi/g
	Vegetation	2.8	pCi/g
Banner Spring Branch Upstream	Water	3.53×10^{-01}	pCi/l
	Sediment	8.1	pCi/g
Martin Creek Upstream	Water	1.2	pCi/l
	Sediment	6.6	pCi/g
Nolichucky River Upstream	Water	8.1×10^{-01}	pCi/l
	Sediment	9.0	pCi/g
Groundwater (Well 52)	Water	5.0×10^{-01}	pCi/l

Source2002 – 2006 (except for Banner Spring Branch Upstream 1999-2003) NFS Environmental Data Management System,

3.12 Waste Management

3.12.1 Liquid Waste

Liquid waste is treated, measured, and sampled. When all parameters are in accordance with the NPDES Permit and 10 CFR 20 the waste effluent is released. The processes are described in section 2.1.2.2(3).

3.12.2 Solid Waste

(1) Non-Radiological/Non-Hazardous

Non-Radiological/Non-Hazardous solid waste (such as waste oil and paper) is shipped off site for treatment, recycling and /or disposal at appropriate facilities.

(2) Radioactive Solid Waste

The disposal and storage of radioactive solid waste is described in section 2.1.2.2(4).

3.12.3 Hazardous and Mixed Waste

(1) Hazardous Waste

The disposal and storage of hazardous solid waste is described in section 2.1.2.2(6) (Non-Radiological/Hazardous Waste).

(2) Mixed Waste

The disposal and storage of mixed solid waste is described in section 2.1.2.2(5).

4.0 Environmental Impact of Proposed Action and Alternative

4.1 Land Use Impacts

Land use on-site (as described in **Table 3**) is not anticipated to change significantly in the near future if the NFS SNM license is renewed. All major operations will continue to be conducted within the Plant Protected Area, with the exception of certain environmental remediation projects. License renewal will not impact land use at the site.

Off-site land use will not be affected by continued licensed operation. Emissions, both chemical and radiological, to air and water have been shown to have an insignificant effect on local air and water quality.

The alternative to license renewal would impact land usage at the site by increasing decommissioning and decontamination activities.

4.2 Transportation Impacts

The transportation of radioactive material to and from the site is not anticipated to change due to license renewal. The quantities and types of materials will not significantly change. The transportation route is not projected to be impacted due the renewal.

The alternative to SNM license renewal would increase radioactive/mixed waste/hazardous shipments from the site until decommissioning activities are completed.

4.3 Geology and Soil Impacts

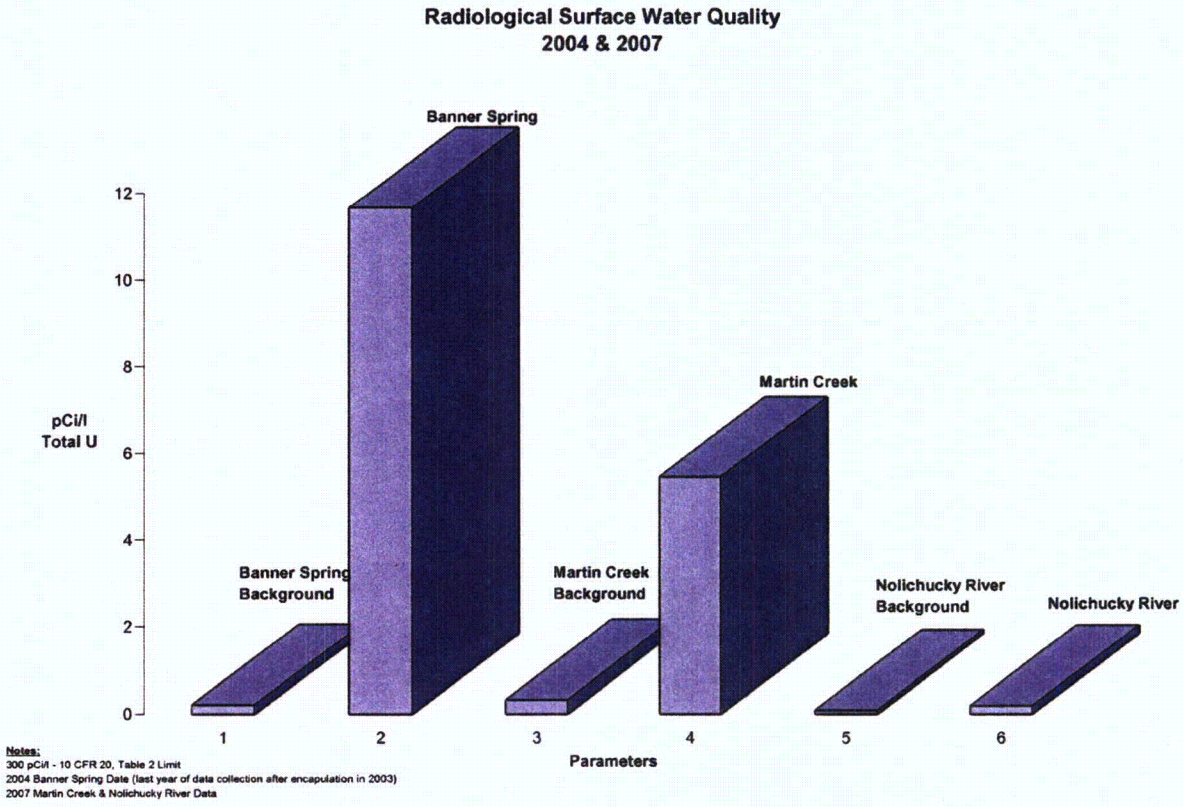
License renewal will not negatively impact the geology or seismology of the NFS site. No major land use changes exist that will adversely affect geology or soil on the NFS site.

The non-renewal option would have an impact on site geology during the decommissioning phase. After the site decommissioning the site, geology should stabilize.

4.4 Water Resources Impacts

Radioactivity levels at downstream locations are compared to background levels in **Figure 5** (Radiological Surface Water Quality). The radiological levels in the stream in **Figure 5** are compared to 10 CFR Part 20, Table 2, Effluent Concentration of 300 pCi/l. **Figure 5** consists of 2004 Banner Spring data (last collection year after encapsulation of Spring in 2003) and 2007 Martin Creek and Nolichucky River data. As demonstrated by **Figure 5**, the concentrations are two orders of magnitude less than the regulatory limit. As indicated in **Figure 5**, there are some increases in levels of radioactivity within Banner Spring and Martin Creek levels, however the Nolichucky River is essentially the same upstream and downstream of NFS.

Figure 5



The chemical impact on surface waters has been estimated by comparing Federal and State guidelines (with downstream data from 1999 through 2003) see **Table 18**, (Chemical Parameters in Surface Water). As shown on **Figure 6** (Chemical Surface Water Quality 1999-2003), the downstream ambient levels of these key constituents are consistently below the most stringent guidelines. The constituents listed in **Table 18** are the most important NFS constituents for which Federal or State water quality standards exist. The applicable water quality standards are also shown for comparison in **Table 18**. The constituent concentrations in the local water are much less than the standard water quality limits. Accordingly, NFS' effluents have an insignificant impact on local water quality.

Operations at the NFS plant are believed to have resulted in the presence of radionuclides and organic constituents in the groundwater beneath the facility. The prime sources of contamination are believed to be: i) three unlined surface impoundments (formerly Ponds 1, 2, and 3), ii) the "Pond 4" disposal area and iii) the burial grounds, all of which are located in the northern portion of the NFS site (GMI 1996). The primary groundwater constituents of concern (that have been found at levels above the drinking water maximum concentration levels (MCLs)) determined within the last two years include trichloroethylene (TCE),

tetrachloroethylene (PCE), 1,2-dichloroethylene (1,2-DCE), vinyl chloride (VCI), tributylphosphate (TBP) and uranium (NFS 1995a and b). NFS has identified the sources and/or source areas for most of these constituents and has proposed further investigation and/or corrective action to address these sources and source areas. Dredging of sediment from the former Ponds 1, 2, and 3 was completed in 1995. Other corrective action work is ongoing. To date, none of these constituents of concern have been detected below the deeper alluvium/shallow bedrock groundwater zone (GMI 1996).

There are no known users of the groundwater between NFS and the River. PCE levels in an up-gradient well have also been measured at levels above the MCL, but lower than that measured in the down-gradient wells. The source of the up-gradient PCE has not been determined. Groundwater collected in monitoring wells on the down-gradient (Plant west) boundary indicates that TCE, PCE, 1,2-DCE and VCI periodically exceed drinking water standards at one or more locations near the western boundary (NFS 1996). NFS is actively working with the TDEC and EPA to design remedial strategies and to investigate the off-site extent of these plumes.

Uranium and PCE are the constituents measured most consistently above MCLs in wells near the down-gradient boundary of the site. In 1996, a groundwater flow and transport model was prepared to forecast the off-site extent of the elevated uranium and PCE levels (GMI 1996). **Figures 7** and **8** depict the model's projections.

Figures 7 and **8** are best estimates and are intended to indicate overall conditions and trends rather than to predict actual concentrations at a specific location. The model predicts that PCE is discharged to the river, where it is expected that PCE levels will continue to remain below detection levels. In November and December 1996, with TDEC and EPA approval, off-site monitoring wells were installed to collect actual down-gradient groundwater data.

Groundwater modeling has shown that contamination from the NFS site should have no impact on the local drinking water supply well. The Erwin Utilities' "Railroad Well," located approximately one mile northeast of, and cross-gradient from, the Plant (GMI 1996) is the local drinking water supply well for the NFS area. This is due to the fact that the capture zone for this water supply well does not appear to intersect the simulated contaminant plume from the NFS site.

Figure 6

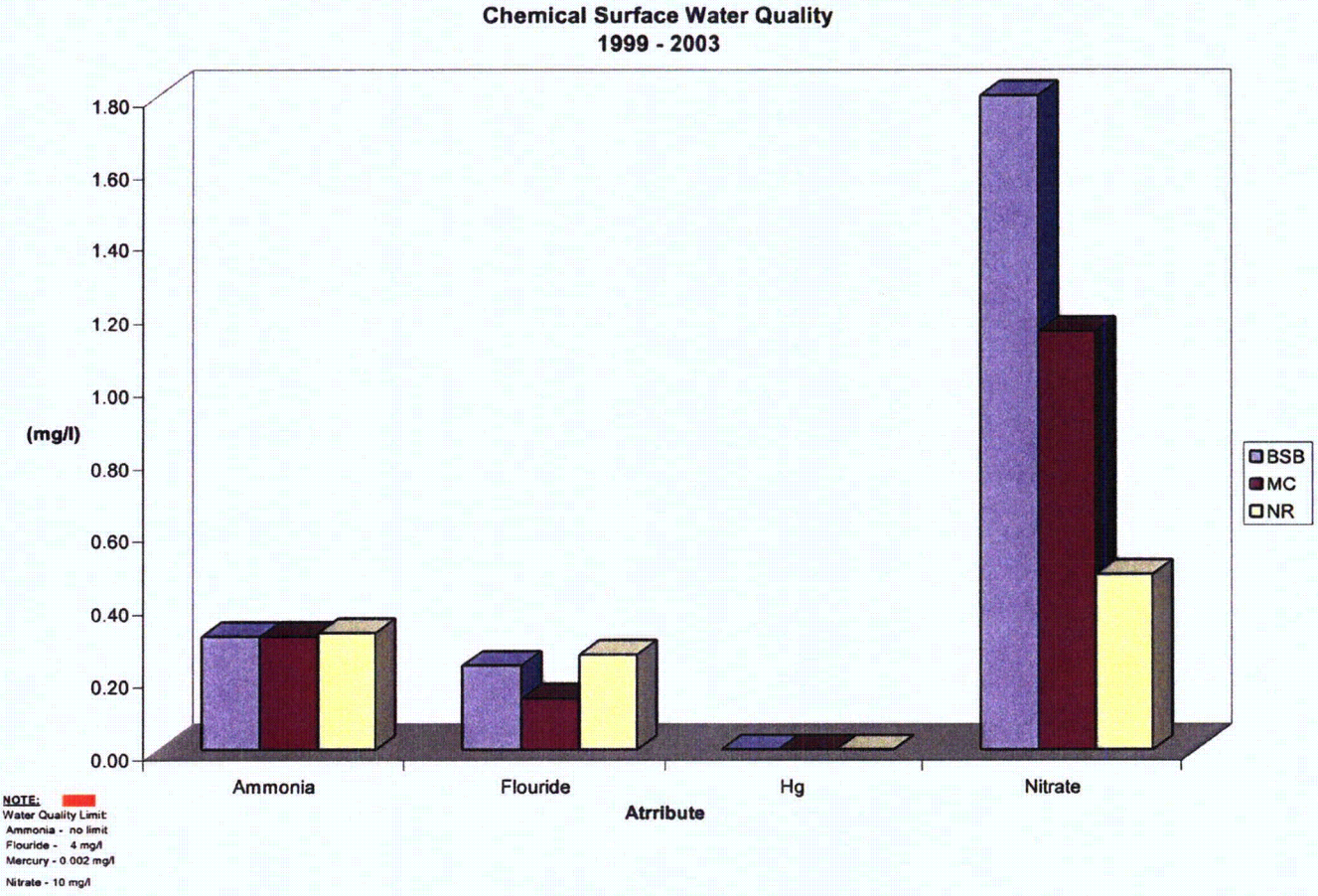

Chemical Surface Water Quality
1999 - 2003
1.80
1.60
1.40
1.20
1.00
(mg/l)
0.80
0.60
0.40
0.20
0.00
Ammonia
Flouride
Hg
Nitrate
Atrribute
BSB
MC
NR
NOTE:
Water Quality Limit:
Ammonia - no limit
Flouride - 4 mg/l
Mercury - 0 002 mg/l
Nitrate - 10 mg/l

Table 18
Chemical Parameters in Surface Water

Attribute	Drinking Water Stds.	1999 Average (mg/l)	2000 Average (mg/l)	2001 Average (mg/l)	2002 Average (mg/l)	2003 Average* (mg/l)
Banner Spring Down						
Ammonia	N/A	< 0.3	< 0.30135	< 0.3	< 0.33325	< 0.3
Fluoride	4.0	0.1616	0.1218	0.1744	0.3874	0.2967
Mercury	0.002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Nitrate	10	1.7486	1.7665	1.698	1.8215	1.9762
pH (SU)	6.5-8.5**	7.5	7.5	7.6	7.6	7.8
Martin Creek Downstream						
Ammonia	N/A	< 0.3	< 0.3004	< 0.3	< 0.3310	< 0.3
Fluoride	4.0	0.0733	0.0604	< 0.08	0.3032	0.1722
Mercury	0.002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0003
Nitrate	10	1.3843	1.1832	1.0132	1.0594	1.1287
pH (SU)	6.5-8.5**	7.4	7.4	7.4	7.6	7.7
Nolichucky River Downstream						
Ammonia	N/A	< 0.325	< 0.3	< 0.3	0.36	0.3
Fluoride	4.0	0.20835	0.2280	0.2156	< 0.4172	0.2332
Mercury	0.002	< 0.0002	< 0.0002	< 0.0002	0.0002	0.0002
Nitrate	10	0.4563	0.5006	0.4346	< 0.4246	0.6018
pH (SU)	6.5-8.5**	7.0	7.0	6.8	7.0	7.1

NOTE:
*Data only includes 1st half of 2003. Banner Spring encapsulation complete in 2003 and chemical data collection stopped after 1st half 2003
**EPA Secondary Drinking Water Standard
No EPA Drinking Water Standard exists for ammonia
N/A No standard listed
Source:
NFS EDMS
EPA Primary Drinking Water Standard

Figure 7
Groundwater Monitoring Locations and Simulated Uranium Concentration Isopleths in Alluvium Layer

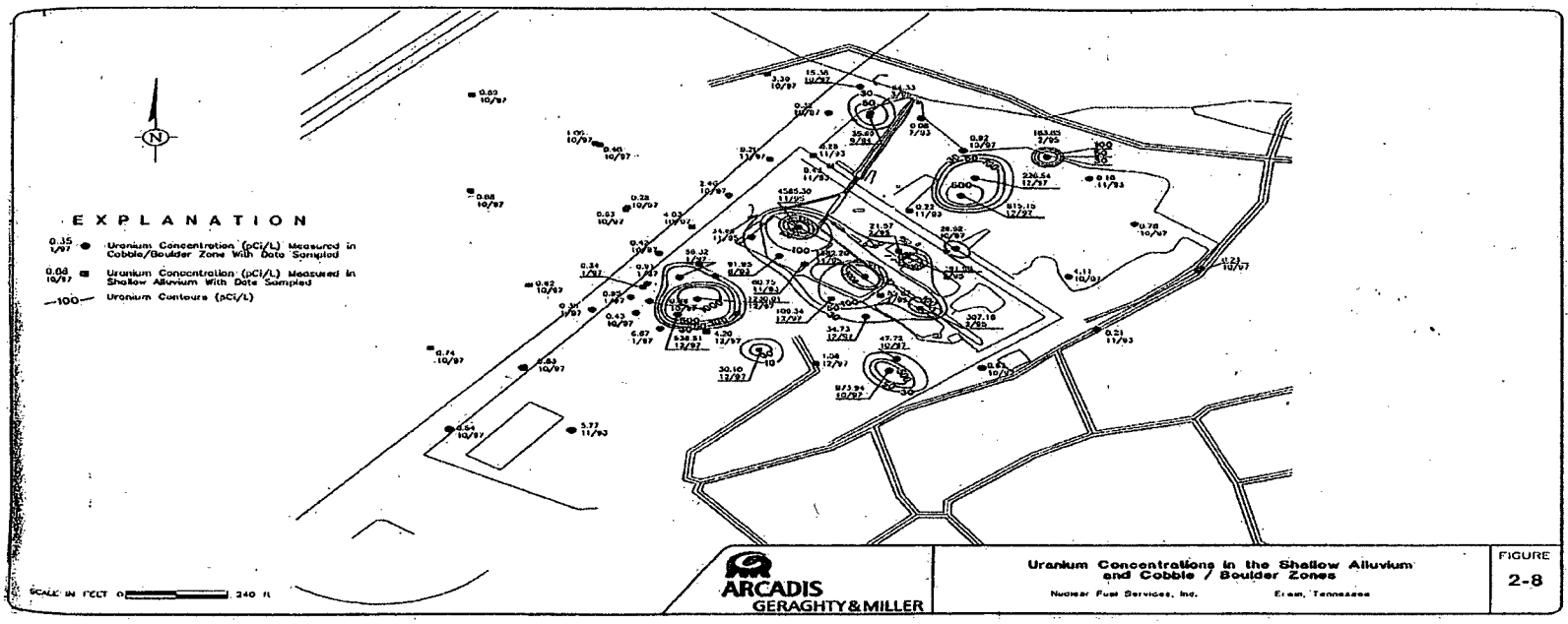
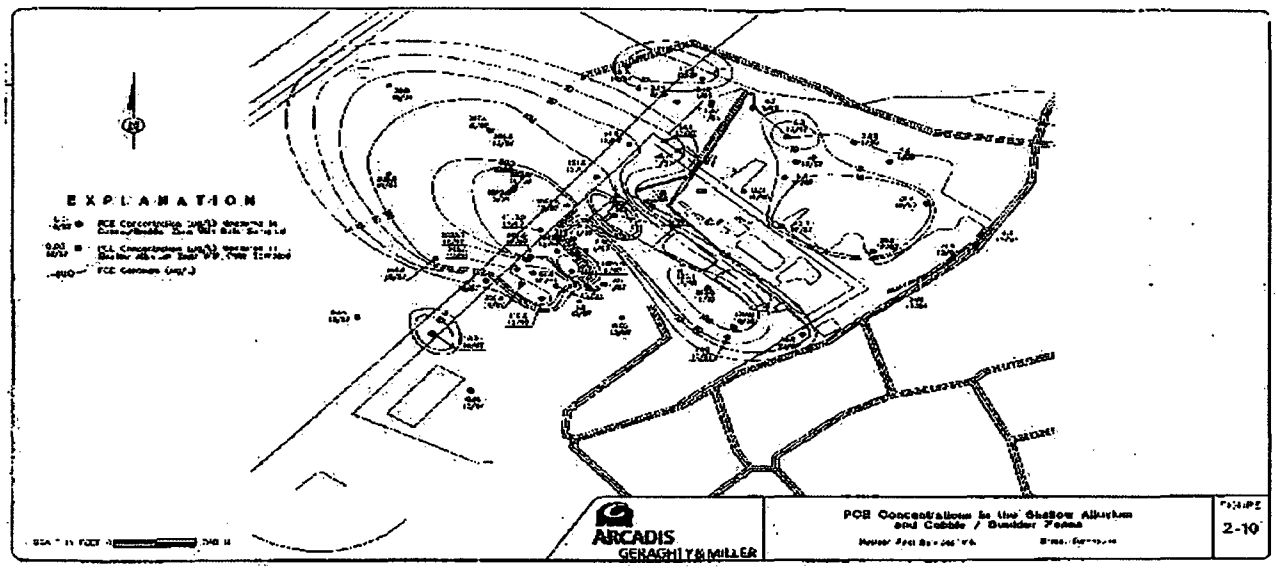


Figure 8
Groundwater Monitoring Locations and Simulated PCE Concentration Isopleths in Alluvium Layer



4.5 Ecological Resources Impacts

Process water discharges (from the NFS WWTF) are only to the Nolichucky River. Since the NFS, discharges are consistently in compliance with its NPDES permit, and since the input represents less than 1% of the flow volume of the river, the potential ecological impact is minimal.

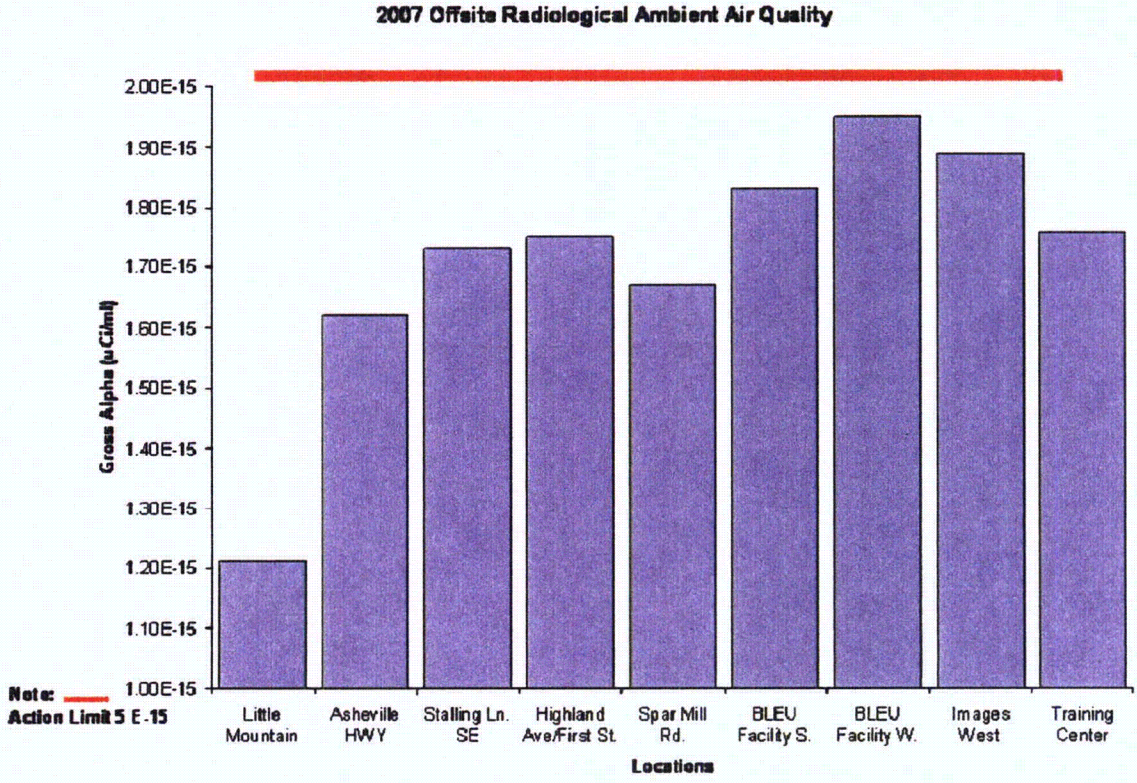
Storm water discharges enter the off-site environment at Banner Spring and Martin Creek. These discharges have no process content and no potential for significant radiological or chemical effect on the ecology of the creek.

4.6 Air Quality Impacts

The radiological air quality impact is depicted in **Figure 9** (2007 Offsite Radiological Ambient Air Quality). The figure shows monitoring results for both the background location (Asheville Highway) and the off-site locations in the near vicinity of NFS. As depicted by **Figure 9**, the radioactivity levels at the designed monitoring stations are statistically within the same range as the background monitoring station (Asheville Highway). All monitoring stations are less than the internal NFS action limit of 5.0 E^{-15} uCi/ml (**Figure 9** Red Line) and the 10 CFR 20 regulatory limit of 3.0 E^{-7} uCi/ml. As shown by **Figure 9** the effluent concentrations in the vicinity of NFS are typically a factor lower than the applicable limit. NFS emissions are not a significant contribution to air quality within the vicinity of NFS.

NFS is not a "major source" of air contaminants (radiological or non-radiological). In addition, many of NFS' emissions are further reduced by the use of effluent control equipment, which minimizes the amount of air contaminants that reach the environment. As demonstrated by **Table 22** (Permitted and Actual Emissions of Criteria and Hazardous Air Pollutants), NFS' actual emissions of air contaminants are significantly less than its permitted emissions. Accordingly, NFS' emissions of non-radiological air contaminants do not have a significant impact on local air quality.

Figure 9


2007 Offsite Radiological Ambient Air Quality
2.00E-15
1.90E-15
1.80E-15
1.70E-15
1.60E-15
1.50E-15
1.40E-15
1.30E-15
1.20E-15
1.10E-15
1.00E-15
Gross Alpha (uCi/ml)
Note:
Action Limit 5 E-15
Little Mountain
Asheville HWY
Stalling Ln. SE
Highland Ave/First St.
Spar Mill Rd.
BLEU Facility S.
BLEU Facility W.
Images West
Training Center
Locations

4.7 Noise Impacts

The renewal of SNM-124 License will not pose additional noise levels. However, the alternative to license renewal will generate increased noise level, due to facility decommissioning.

4.8 Historic and Cultural Impacts

Under the License Renewal Alternative, operations, decommissioning and remedial activities at the NFS site would continue essentially, as they are today. No significant construction is anticipated at the site related to NFS' license activities and no significant portions of the site would be disturbed as a consequence of license renewal.

The effects considered include those resulting directly from land disturbance during construction, visual intrusion on the settings or environmental context of historical structures, visual and audio intrusions on Native American sacred sites, reduced access to Native American traditional use areas, unauthorized artifact collection, and vandalism.

No current or threatened impacts to potentially significant pre-historic, historic, or cultural resources have been identified by NFS.

Under the No License Renewal Alternative, eventually all buildings on the site would be decommissioned and either put to other productive use or demolished. If significant demolition were to occur, any potentially significant historical and/or cultural resources currently on the site (currently none are known) could be damaged or destroyed.

4.9 Visual/Scenic Resources Impacts

The licensing renewal will have no impact on visual/scenic resources. The alternative of no license renewal will impact these resources due to decommissioning activities.

4.10 Socioeconomic Impacts

Employment at NFS has remained steady since 2004 as shown in **Table 19** (NFS Annual Employment).

Table 19 NFS Annual Employment	
Year	**No of Employees**
2004	715
2005	711
2006	695
2007	730
2008	800

NOTE:
2004-2007 is as of Dec. 31
2008 data is as of Sep. 30

Employment has increased from 715 in 2004 to 800 as of September 30, 2008. The projected 2008 employment is approximately 831 individuals. The unemployment rates for the ROI from July 2007 to July 2008 are described in **Table 20** (ROI Unemployment Rate).

Table 20 ROI Unemployment Rate			
ROI	**July 2007 (%)**	**July 2008 (%)**	**Change (%)**
Carter County	4.8	6.9	2.1
Sullivan County	4.3	6.1	1.8
Unicoi County	4.4	7.0	2.6
Washington County	4.1	6.1	2.0

Source:
Tennessee Department of Labor & Workforce Development, July 2008

The average per capita income in Tennessee in 2005 was $30,969.00. **Table 21** (2005 ROI Per Capita Income) shows the per capita income in 2005 for the ROI. The average NFS 2005 salary is $95,613.00 (with benefits) or $57,032.00 (without benefits), which greatly exceeds the ROI per capita income. This demonstrates NFS' positive influence on the socioeconomics of the ROI.

Table 21 2005 ROI Per Capita Income	
Counties	**Income**
Carter	$22,021.00
Sullivan	$29,077.00
Unicoi	$26, 044.00
Washington	$28,115.00
Source: Tennessee Department of Labor & Workforce Development, July 2007	

Under the "No Renewal Alternative," a significant portion of the 831 NFS employees would lose their jobs, as the only operational activities would be decommissioning. This would further increase the unemployment rate as well as greatly impacting the tax revenues in the ROI. The counties within the ROI would experience negative socioeconomic impacts due to NFS downsizing.

4.11 Environmental Justice

NFS, in accordance with the NRC's Environmental Justice Strategy (NRC 1995) and Executive Order 12898 (EXO 1994), has evaluated whether any of its programs, policies and activities have disproportionately high and adverse effects on low-income and minority populations.

4.11.1 Local Minority and Low-Income Population Information

The local minority and low-income population encompass the counties of Carter, Sullivan, Unicoi, and Washington as shown in **Table 15**. **Table 15** provides the demographic characteristics for the ROI. The minority population in the ROI represents 21.3% of the total population. The area surrounding NFS is predominately non-minority. NFS provides approximately 1.47% of the regional employment within the ROI. **Table 12** identifies Carter County (16.6%) and Washington County (13.6%) with the highest percent of individuals living below the poverty level. Washington County population is the most positively influenced by the NFS employment trends.

Review of the above socioeconomic data and land use information demonstrates that no disproportionate adverse impact to the minorities or low-income population in the ROI will occur from this license renewal.

4.11.2 Evaluation of Disproportional Impacts

Any impacts to the communities surrounding NFS would most likely be the result of hazardous and/or radioactive air emissions or accidents. No significant adverse human health or environmental impacts have been identified by NFS as being associated with its activities. In addition, NFS facilities are designed with extensive safeguards to prevent accidents, and should an accident occur, no acute health impacts would be expected to result. Because the area surrounding NFS is predominately non-minority and is not low-income, significant adverse human health or environmental impacts, if any, would not disproportionately affect minority or low-income populations.

4.12 Public and Occupational Health Impacts

4.12.1 Nonradiological Impacts

(1) Air

No routine monitoring is currently conducted for non-radiological constituents. However, **Table 22** (Permitted and Actual Emissions of Criteria and Hazardous Air Pollutants) estimates the NFS

contribution of pollutants to ambient air. **Table 22** demonstrates that the estimated concentrations are in compliance with applicable guidelines and regulations.

Table 22

Permitted and Actual Emissions of Criteria and Hazardous Air Pollutants

Pollutant	*Emission Limitations (tons/yr)*	
	Actual	*Allowable*
Particulate	2.1	53.8
Sulfur dioxide	2.0	30.6
Carbon monoxide	1.4	2.8
Volatile organic compounds	1.8	4.4
Nitrogen oxides	1.9	57.1
Hydrogen fluoride	0.09	0.26
Hydrogen chloride	0.07	0.93
Vinyl chloride	0.01	0.01
Tetrachloroethylene	0.21	0.21
Trichloroethylene	0.06	0.06
Bis-2-ethylhexylphthalate	0.01	0.01
Mercury	0.005	0.007

[a] *Information summarized from NFS air permits in effect as of 10/22/2008*

(2) Surface Water

Three (3) surface water bodies, Banner Spring Branch, Martin Creek, and the Nolichucky River are potentially affected by Plant operations. Up until second quarter 2003, these water bodies were routinely monitored for the following potential NFS pollutants: ammonia, nitrates, fluoride, mercury, and acidity/alkalinity (pH). **Table 18** (Chemical Parameters in Surface Water) demonstrates that these water bodies were not significantly impacted from plant operations. All water attributes are below the National Primary Drinking Water Standard. In the second half of 2003, NFS discontinued monitoring for these attributes, because the statistical background of this data demonstrated no significant trends or change due to plant operations.

(3) Soil and Vegetation

No routine monitoring of soil and vegetation is conducted for chemical parameters.

(4) Groundwater

NFS has conducted extensive groundwater investigations and routine monitoring since at least 1990 in conjunction with its Hazardous Waste Permit. Recently, routine monitoring is performed for Area of Concern (AOC) groundwater (GW) which is site wide groundwater. AOC GW is a combination of Solid Waste Management Units (SWMUs) and AOCs that require corrective measures for groundwater. Additionally, monitoring is performed to track groundwater remediation progress in an area of the plant site near the maintenance shop area. Approximately 70 wells are routinely sampled and analyzed for various parameters on either an annual, semi-annual, quarterly, or monthly basis. A

summary of this monitoring and remediation progress is shared and discussed with TDEC Hazardous Waste Management at the semi-annual Facility Action Plan (FAP) workshop and additionally is captured in a Facility Action Plan (FAP) document that is updated annually.

4.12.2 Radiological Impacts

4.12.2.1 Pathway Assessment

(1) Air, Soil Vegetation, Sediment, and Surface Water

The following tables give annual average data for each of the environmental media sampled at locations considered part of the minimum surveillance program: **Table 23A** (Environmental Average Gross Radioactivity), **Table 23B-1** (Stream Sediment, Soil, and Vegetation Average Radioactivity First Half 2007), **Table 23B-2** (Stream Sediment, Soil, and Vegetation Average Radioactivity Second Half 2007), **Table 23C** (2004 Banner Spring Branch Downstream Environmental Monitoring Data), **Table 23D** (2007 Martin Creek Downstream Environmental Monitoring Data), and **Table 23E** (2007 Nolichucky River Downstream Environmental Monitoring Data), These tables do not include data associated with samples collected within the Plant Protected Area, which are not representative of off-site conditions.

Table 23A

Environmental Air Average Gross Radioactivity (uCi/ml)		
Parameter Location	**1st Half 2007**	**2nd Half 2007**
170-Perimeter NW	1.75E-15	2.87E-15
171-Perimeter W	3.89E-15	2.23E-15
172-Perimeter S	1.74E-15	2.14E-15
174-Perimeter E #1	1.54E-15	2.16E-15
218-Perimeter E #2	1.26E-15	2.23E-15
322-Little Mountain	8.77E-16	1.54E-15
323-Banner Hill Road	1.39E-15	2.40E-15
324-Asheville Hwy.	1.27E-15	1.97E-15
372-Parking Lot Entrance	1.61E-15	2.24E-15
381-BH Road/Stalling	1.54E-15	2.26E-15

Source: NFS EDMS 2007

Table 23B-1

Stream Sediment, Soil, & Vegetation
Average Radioactivity
First Half 2007

Parameter Location	Gross Alpha		Gross Beta		Total U	
	pCi/g	Error +/-	pCi/g	Error +/-	pCi/g	Error +/-
Sediment						
Martin Creek Down @ Linear Park	8.15	3.33	14.2	3.72	U 2.09	0.53
Martin Creek Down @ RR Trestle	7.17	2.96	19.7	4.38	U 1.54	0.43
Martin Creek Up	5.51	2.44	7.51	3.19	U 0.79	0.32
Nolichucky River Downstream	9.38	3.39	18.5	3.97	U 1.13	0.39
Nolichucky River Upstream	14.2	4.12	32.4	4.91	U 1.28	0.41
Soil						
Asheville Highway	18.1	5.52	39.8	6.27	U 2.38	0.57
Banner Hill Road	22.1	5.61	18.9	4.66	3.85	0.78
Burial Ground	17.4	4.58	26.1	4.65	U 4.24	0.98
First Street	14.5	3.84	17.8	3.93	U 2.37	0.61
Little Mountain	17.7	4.51	11.9	3.82	U 3.38	0.73
Vegetation						
Asheville Highway	U 1.95	1.84	13.6	4	U 0.24	0.25
Banner Hill Road	U 2.08	1.89	U 7.77	3.43	U 0.29	0.29
Burial Ground	U 2.08	1.86	13.5	3.97	U 0.69	0.27
First Street	U 4.2	2.19	17.1	3.92	U 0.84	0.44
Little Mountain	U 3.97	2.01	19.1	4.1	U 0.75	0.34

Note:

U = Below Lab Detection Limits

Total U = U-233/234 + U-235/236 + U-238

Sources: NFS EDMS 2007

Table 23B-2

STREAM SEDIMENT, SOIL, AND VEGETATION AVERAGE RADIOACTIVITY Second Half 2007						
	Gross Alpha		Gross Beta		Total U	
Parameter Location	pCi/g	Error +/-	pCi/g	Error +/-	pCi/g	Error +/-
Sediment						
Martin Creek Down @ Linear Park	4.9	2.08	13.58	2.35	U 1.99	0.48
Martin Creek Down @ RR Trestle	9.43	2.46	9.94	2.1	4.42	0.69
Martin Creek Up	5.12	2.07	6.66	2.1	U 0.91	0.32
Nolichucky River Downstream	7.09	2.38	13.25	2.48	U 0.97	0.32
Nolichucky River Upstream	6.31	2.83	19.25	3.21	U 2.68	0.47
Soil						
Asheville Highway	27.3	6.13	41.4	4.93	U 1.89	0.45
Banner Hill Road	11.69	4.4	16.55	4.13	3.81	0.65
Burial Ground	19.5	3.74	21.95	2.99	4.19	0.67
First Street	14.8	4.56	14.45	3.8	U 2.31	0.5
Little Mountain	18.44	5.18	10.64	3.43	U 3.44	0.61
Vegetation						
Asheville Highway	U 1.56	2.09	19.45	4.35	U 0.12	0.13
Banner Hill Road	U 0.89	1.84	24.25	4.53	U 0.05	0.11
Burial Ground	U 1.66	2.22	23.3	4.25	U 0.26	0.17
First Street	U 3.03	2.46	17.68	4.22	U 0.27	0.18
Little Mountain	U 3.85	2.77	19.04	4.19	U 0.64	0.24

U = Below Lab Detection Limits
Total U = U-233/234 + U-235/236 + U-238
Sources: NFS EDMS 2007

Table 23C

2004 Banner Spring Downstream Environmental Monitoring Data								
Collection	**Gross Alpha**			**Gross Beta**		**Total U**		
Date		**pCi/l**	**Error +/-**	**pCi/l**	**Error +/-**		**pCi/l**	**Error +/-**
Jan-04		5.1	0.78	29.3	1.32	U	0.63	0.57
Feb-04	U	0.5	0.51	2.45	0.89	U	0.46	0.36
Mar-04	U	0.17	0.47	6.17	1.42	U	0.43	0.64
Apr-04		2.37	0.64	2.12	0.51	U	0.69	0.41
May-04		1.56	0.52	2.39	0.62	U	1.01	0.89
Jun-04	U	1.67	0.77	1.96	1.1	U	0.39	0.42
Jul-04	U	0.35	0.68	3.78	1.27	U	0.26	0.37
Aug-04		2.15	1.14	1.66	0.68	U	1.46	0.55
Sep-04		12.9	1.43	3.95	1.32		11.78	2.29
Oct-04		5.39	1.57	2.21	0.91	U	2.54	1.14
Nov-04		5.13	0.91	2.39	0.68	U	5.34	1.66
Averages	U	3.39	0.86	5.31	0.97	U	2.27	0.85

NOTE:
2004 last year of Banner Spring Branch data collection
U = Below Lab Detection Limits
Total U = U-233/234 + U-235/236 + U-238
Source NFS EDMS 2004

Table 23D

2007 Martin Creek Downstream Environmental Monitoring Data									
Sampling Period	**Gross Alpha**			**Gross Beta**			**Total U**		
		pCi/l	**Error +/-**		**pCi/l**	**Error +/-**		**pCi/l**	**Error +/-**
Jan-07		4.99	0.71	U	-1.32	1.02	U	0.38	0.64
Feb-07	U	0.27	1.01		3.04	1.78	U	1.99	1.5
Mar-07		3.05	0.79		2.32	0.63	U	3.56	1.64
Apr-07		4.8	1.34		2.89	1.39	U	5.06	1.2
May-07		0.79	0.43		2.07	0.89	U	0.71	0.66
Jun-07	U	1.49	1.18	U	2.11	1.77	U	1.89	1.21
Jul-07		2.25	1.41		2.5	1.51	U	2.73	1.25
Aug-07		1.46	0.5		3.8	0.58	U	1.38	0.47
Sep-07		2.08	1.57		6.5	2.1	U	1.63	1.17
Oct-07	U	1.51	1.32	U	0.88	1.64	U	0.68	0.65
Nov-07	U	1	0.82		4	1.63	U	0.61	0.6
Dec-07		1.28	0.47		1.8	0.43	U	0.93	0.61
Averages	U	2.08	0.96	U	2.55	1.28	U	1.80	0.97

NOTE:
U = Below Lab Detection Limits
< - Less than detection limit
Total U = U-233/234 + U-235/236 + U-238
Includes only monthly samples.
Source: NFS EDMS 2007

Table 23E

2007 Nolichucky River Downstream Environmental Monitoring Data								
Sampling Period	**Gross Alpha**			**Gross Beta**			**Total U**	
		pCi/l	**Error +/-**		**pCi/l**	**Error +/-**		**pCi/l**	**Error +/-**
Jan-07	U	1	0.87	U<	2.54	1.32	U	4.63	1.54
Feb-07	U	0.78	0.98		3.38	1.82	U	0.22	0.62
Mar-07	U<	1	0.49	U	0.82	0.93	U	0.58	0.68
Apr-07	U	0.54	0.6	U	0.88	1.15	U	0.19	0.32
May-07	U	0.14	0.33		1.46	0.73	U	0.24	0.52
Jun-07		1.63	0.64		1.81	1.09	U	0.76	0.79
Jul-07		4.27	2.14		6.49	2.27	U	0.57	0.53
Aug-07	U	0.58	0.43		1.33	0.51	U	0.06	0.15
Sep-07	U<	1.72	0.42		4.76	1.88	U	0.45	0.55
Oct-07	U<	1.42	0.48		7.4	2.05	U	0.01	0.44
Nov-07	U	0.71	0.97		2.32	1.34	U	0.08	0.46
Dec-07	U	0.78	0.57		2.43	0.58	U	0.21	0.2
Averages	U<	1.21	0.74		2.97	1.31	U	0.67	0.57

NOTE:
U = Below Lab Detection Limits
< - Less than detection limit
Total U = U-233/234 + U-235/236 + U-238
Includes only monthly samples.
Source: NFS EDMS 2007

(2) Groundwater

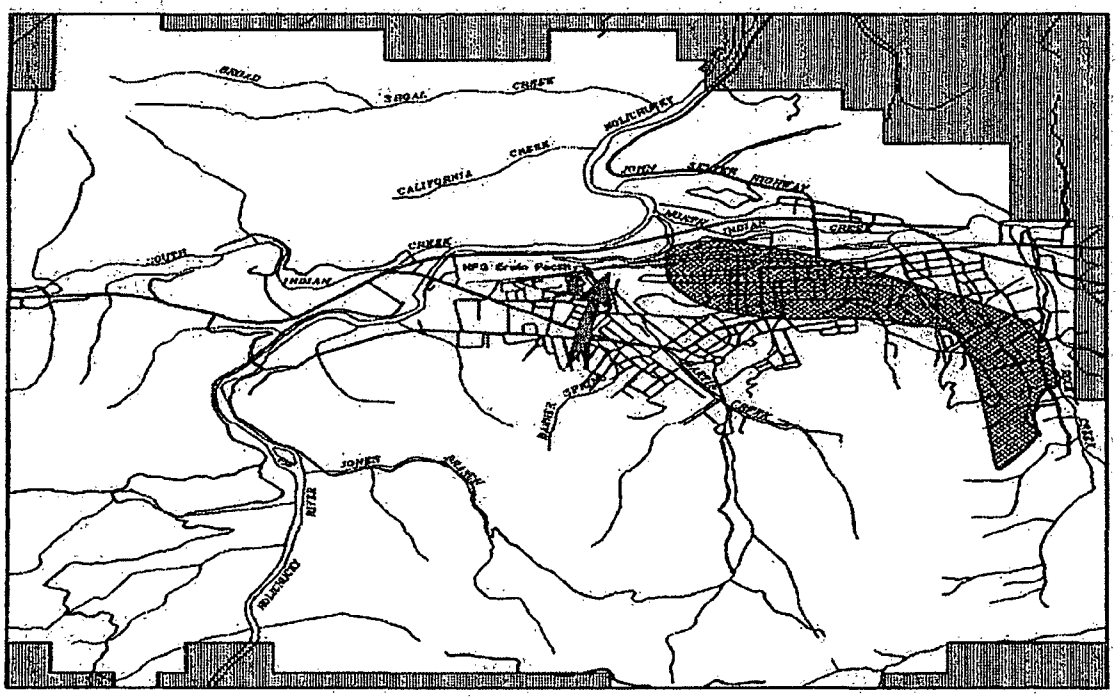
NFS maintains a large array of groundwater monitoring wells. The primary function of these wells is to allow monitoring for uranium contamination, which is the major radiological constituent of interest for NFS. Some of these wells are included specifically to comply with license requirements to monitor the groundwater in the vicinity of the following previous sites:

- The three (3) former waste water retention ponds;
- The main burial ground (north site);
- The former burial trenches on CSX property (west of site); and
- The former two 6,000-gal underground tanks (located just north of the Building 300 Complex).

Other wells are in place to monitor the conditions of groundwater both on- and off-site. Due to the complexity of the program, the results of monitoring are best expressed through isopleths (or

"contour") maps. **Figures 7, 8,** and **10** provide isopleths for the concentrations of contaminants on site.

Figure 10
Capture Zone for Railroad Water Supply Well



4.12.2.2 Public and Occupational Exposure

(1) Pubic Radiation Exposure

As required by NRC regulations, NFS strives to ensure that all releases, emissions, etc., of radioactive material remain "As Low As is Reasonably Achievable" (ALARA). The measured off-site air quality (discussed in Section 4.2) confirms the success of these efforts and that off-site exposure to the public from Plant air emissions is minimal. However, in order to document compliance with federal and state standards for exposure to members of the public, NFS routinely prepares formal estimates of the exposure. **Table 24** (Radiation Exposure to Members of the Public) shows the results for the period 2004 through 2007, as compared to the permissible public exposure limit.

Radiation exposure to members of the public is estimated using local wind speed and direction frequency information, combined with effluent release data (**Tables 25A** and **25B**). The data is used in standard atmospheric dispersion modeling techniques to estimate the exposures to members of the public. These calculated exposures, based on site-specific data, confirm that exposures to the "maximally exposed individual" consistently remain at only a small fraction of the allowable exposure limit.

Table 24

Radiation Exposure to Members of the Public

Year	*CEDE* [a]	*Percent of Limit* [b]
2004	0.013	0.01
2005	0.0067	0.03
2006	0.0044	0.02
2007	0.002	0.01
Average	0.0065	0.02

[a] *Committed Effective Dose Equivalent from gaseous effluent to the maximally exposed individual*
[b] *Limit=25 mrem/yr, 40 CFR Part 190, Subpart B.*
Source: NFS 2004 - 2007

Renewal of the SNM-124 license would ensure that public exposure remains ALARA and within Nuclear Regulatory Commission limits.

(2) Potential Impact for Accidents

Postulated accidents are described in Section 2.0. While NFS recognizes the potential for these types of accidents, the probability of any of them occurring is low due to engineered safety factors incorporated into the process design. NFS process designs incorporate sufficient safety controls to ensure that any accident sequence (radiological or chemical) resulting in a high or intermediate consequences meet the performance requirements specified in 10 CFR Part 70.61.

As discussed in Section 2.0, in conjunction with NFS Emergency Plan, a detailed analysis of five (5) potential accident scenarios has been evaluated. While NFS has classified these scenarios as potential, the probability of any of them occurring is low, due to safety factors incorporated into the design of all radiological material related process equipment and systems. For these accidents to occur, it would require at least two unlikely, independent, and concurrent changes in process conditions. This redundancy provides a significant margin of protection against accidents occurring.

The level of protection against significant accidents is substantiated by review of past incidents. Section 2.0 lists the most significant environmental accidents during recent Plant history. A review of Section 2.0 indicates no event that significantly threatened the safety of members of the public.

Based on the review of potential accidents, actual environmental releases, and the comprehensive safety programs in place to prevent and minimize the effect of accidents, the probability and potential consequences of any reasonably foreseen significant site-related accident with off-site consequences are both estimated to be low.

Renewal of the SNM-124 license would not significantly threaten the safety of members of the public.

Table 25A
Radioactivity in Effluent Air
(January 1, 2007 – June 30, 2007)

Emission Point	Gross Alpha Released (µCi/period)	Weighting Factor	Stack Flow Rate (m^3/sec)	Physical Discharge Height (m)	Hydraulic Diameter (m)	Air Exit Velocity (m/s)
Effective Emission Point #1						
416	2.11E+01	1.0000	15.93	32.92	1.524	8.74
Weighted Average:				**32.92**	**1.52**	**8.74**
Effective Emission Point #2						
501	4.44E-02	0.9303	1.02	15.24	0.356	10.25
502	0.00E+00	0.0000	3.52	21.34	0.509	17.31
503	3.32E-03	0.0697	0.10	19.51	0.076	22.05
Weighted Average:				**15.54**	**0.34**	**11.08**
Effective Emission Point #3						
234	0.00E+00	1.0000	0.00	10.24	0.610	0.00
Weighted Average:				**10.24**	**0.61**	**0.00**
Effective Emission Point #4						
185	0.00E+00	0.0000	1.67	10.36	0.305	22.87
327	3.66E-02	0.0048	10.09	20.99	1.219	8.65
376	0.00E+00	0.0000	2.46	15.00	0.610	8.42
421	8.20E-02	0.0108	0.50	5.50	0.305	0.00
424	0.00E+00	0.0000	0.50	5.49	0.305	0.00
573	0.00E+00	0.0000	1.13	15.70	0.343	12.24
600	7.32E+00	0.9636	6.09	18.90	0.711	15.35
615	0.00E+00	0.0000	0.54	9.75	0.254	0.00
646	0.00E+00	0.0000	0.85	10.02	0.305	11.64
649	0.00E+00	0.0000	0.00	15.24	0.254	0.00
701	1.58E-01	0.0207	2.81	22.29	0.397	0.00
702	0.00E+00	0.0000	2.53	22.29	0.444	0.00
Weighted Average:				**18.84**	**0.70**	**14.83**
Effective Emission Point #5						
703	1.32E-01	1.0000	12.42	16.59	0.813	23.94
704	0.00E+00	0.0000	0.80	21.94	0.353	8.16
Weighted Average:				**16.59**	**0.81**	**23.94**

Source:
Semi-Annual Assessment of Radioactive Air Emission 1st Half 2007
Note:
Stacks 421,424,615,701, & 702 are assigned exist velocities of zero, because they have "rain caps."

Table 25B
Radioactivity in Effluent Air
(July 1, 2007 – December 31, 2007)

Emission Point	Gross Alpha Released (µCi/period)	Weighting Factor	Stack Flow Rate (m^3/sec)	Physical Discharge Height (m)	Hydraulic Diameter (m)	Air Exit Velocity (m/s)
Effective Emission Point #1						
416	2.42E+01	1.0000	15.33	32.92	1.524	8.41
Weighted Average:				**32.92**	**1.52**	**8.41**
Effective Emission Point #2						
501	1.09E-01	0.3563	1.05	15.24	0.356	10.55
502	1.89E-01	0.6178	3.53	21.34	0.509	17.36
503	7.91E-03	0.0259	0.10	19.51	0.076	22.05
Weighted Average:				**19.12**	**0.44**	**15.05**
Effective Emission Point #3						
234	0.00E+00	1.0000	0.00	10.24	0.610	0.00
Weighted Average:				**10.24**	**0.61**	**0.00**
Effective Emission Point #4						
185	5.49E-02	0.0108	1.67	10.36	0.305	22.87
327	8.75E-01	0.1729	3.31	20.99	1.219	2.84
376	6.53E-02	0.0129	1.86	15.00	0.610	6.37
421	1.09E-01	0.0215	0.43	5.50	0.305	0.00
424	1.19E-02	0.0023	0.49	5.49	0.305	0.00
573	1.07E-02	0.0021	1.21	15.70	0.343	13.10
600	3.28E+00	0.6486	5.36	18.90	0.711	13.51
615	1.59E-02	0.0031	0.54	9.75	0.254	0.00
646	3.06E-02	0.0060	0.86	10.02	0.305	11.78
649	0.00E+00	0.0000	0.00	15.24	0.254	0.00
701	4.42E-01	0.0873	2.81	22.29	0.397	0.00
702	1.64E-01	0.0323	2.52	22.29	0.444	0.00
Weighted Average:				**19.12**	**0.74**	**9.68**
Effective Emission Point #5						
703	1.33E+00	0.9564	12.81	16.59	0.813	24.69
704	6.05E-02	0.0436	1.14	21.94	0.353	11.63
Weighted Average:				**16.82**	**0.79**	**24.12**

Source:
Semi-Annual Assessment of Radioactive Air Emission 2nd Half 2007
Note:
Stacks 421,424,615,701, & 702 are assigned exist velocities of zero, because they have "rain caps."

4.13 Waste Management

Waste management at the NFS site is conducted as stated in sections: 2.1.2.1(5) (Radioactive Waste Management), 2.1.2.2(2) (Liquid Waste Storage), 2.1.2.2(4) (Radioactive Solid Waste Management), 2.1.2.2(5) (Mix Waste Management), 2.1.2.2(6) (Non-Radioactive Hazardous Waste), and 2.1.2.2(7) (Non-Radioactive/Non-Hazardous Waste). The renewal of the license would not significantly increase the quantities or types of waste generated at the NFS site.

The alternative to license renewal would in the short term, increase waste generation. The decommissioning of the facility would generate large quantities of waste until completion.

5.0 Mitigation Measures

Mitigation measures are design into all process operations and evaluated prior to implementation. NFS strives to control all emissions at the source and to the degree possible mitigate uncontrolled releases. NFS' goal is to maintain occupational and public exposure to radioactive material to "As Low As is Reasonably Achievable" (ALARA). The ALARA goal is detailed in section 4.12 (Public and Occupational Health Impacts).

NFS recognizes the potential for accidents such as those postulated in section 2.0. The probability of these accident occurring is low due to engineered safety factors incorporated into the process designs. Section 2.0 indicates that no event significantly threatened the safety of members of the public.

No disproportionate impacts are expected to occur due to this licensing action. No additional mitigative measures are necessary at this time.

6.0 Environmental Measurements and Monitoring Programs

The NFS environmental monitoring program is a comprehensive program that encompasses onsite and offsite effects environmental surveillance (see Section 4.0). Environmental media monitoring includes air, surface water, silt, soil, vegetation, and groundwater. **Figure 11** (Environmental Air Sample Locations) and **Figure 12** (Surface Water Sample Locations) shows the locations where samples of each media type are taken, except groundwater, which is shown on **Figure 7** (Groundwater Monitoring Locations and Simulated Uranium Concentration Isopleths in Alluvium Layer) and **Figure 8** (Groundwater Monitoring Locations and Simulated PCE Concentration Isopleths in Alluvium Layer).

6.1 Radiological Monitoring

The radiological monitoring program is described in section 4.0.

6.2 Physiochemical Monitoring

6.2.1 Air

Ambient concentrations of atmospheric chemical pollutants near the NFS site are not routinely measured. The primary NFS emission source of criteria pollutants is the industrial boiler. The secondary emission source is chemical processing. **Table 22** (Permitted and Actual Emissions of Criteria and Hazardous Air Pollutants) presents the currently permitted maximum (allowable) and average actual emissions of chemical pollutants.

6.2.2 Surface Water

The NFS WWTF discharges water to the Nolichucky River from Outfall 001, which is located at mile marker 94.6. **Table 26** (NPDES Outfall Monitoring Data) provides effluent quality data for the NFS WWTF outfall for the period 2003 through 2005. This data indicates discharges from the WWTF consistently comply with the limitations imposed by the NFS NPDES permit.

Table 26

NPDES Outfall Monitoring Data

	mg/l (except as noted)	
Effluent Characteristic	*Average* [a]	*Maximum*
COD	202	252
TSS	3 mg	4 mg
Ammonia(N)	2lb./d	4 lb./d
Nitrates(N)	41lb./d	57 lb./d
Fluoride, Total	10 mg	10 mg
Cadmium, Total	0.002	0.002
Copper, Total	0.013	0.013
Lead, Total	0.007	0.007
Mercury, Total	0.001	0.001
Silver, Total	0.004	0.0059
pH	Range 6.1 - 8.9	

Note:
Data is from 2003-2005 and has been deemed representative of NFS' historic discharges as summarized in NPDES Renewal Application dated March 1. 2005.
[a] For some constituents, the calculated average is an estimated quantity, which consists of detected values and reported non-detected samples. The average was determined by using the quantitation limit when non-detects occurred; thus, the actual concentrations were probably lower.

NFS National Pollution Discharge Elimination System Industrial Storm Water Permit monitors storm water runoff. The NFS main plant site and the BLEU Complex have two separate storm water permits. Compliance storm water sampling is conducted annually at each site, as shown in **Table 27** (NFS 2007 – 2008 Storm Water Data) and **Table 28** (BLEU Complex 2007 – 2008 Storm Water Data). The annual monitoring data identifies nitrate as nitrogen and magnesium in storm water at concentrations above the monitoring cut-off concentrations. These two attributes have exceeded the cut-off concentration limit since February 1998. An investigation into the elevated nitrate as nitrogen and magnesium attributes identified that they are natural occurring in surface water and ground water at levels above the NPDES cut-off concentration limits. The aluminum and copper contributors are unidentified.

Three (3) surface water bodies, Banner Spring Branch, Martin Creek, and the Nolichucky River were monitored up until second quarter 2003. They were routinely monitored for the following potential NFS pollutants: ammonia, nitrates, fluoride, mercury, and acidity/alkalinity (pH). **Table 18** (Chemical Parameters in Surface Water) demonstrates that these water bodies were not significantly impacted from plant operations. All water attributes are below the National Primary Drinking Water Standard. In the second half of 2003, NFS discontinued monitoring for these attributes, because the statistical background of this data demonstrated no significant trends or change due to plant operations.

Table 27
NFS 2007-2008 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)
COD	**120**	70.3	57.4	17.2	91.3
pH	**5.0 – 9.0 s.u.**	8.2	7.6	8.7	8.0
TSS	**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		6/19/07	8/25/08	6/19/07	8/25/08
Rain Fall (in)	**≥0.1**	1.3	0.61	1.3	0.61

NOTES:
Outfall C: No Chemical or Radiological Sampling Required
NL: No Permit Limit

Table 28

BLEU Complex

2007 – 2008 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 U234 (pCi/l)	**NL**	<0.330	<0.408
Isotopic U235 (pCi/l)	**NL**	<0.451	<0.315
Isotopic U238 (pCi/l)	**NL**	<0.330	<0.408

Note:
NL: No Permit Limit

6.2.3 Soil and Vegetation

No routine monitoring of soil and vegetation is conducted for chemical parameters.

6.2.4 Groundwater

NFS has been conducting extensive groundwater investigations since at least 1990 in conjunction with its Hazardous and Solid Waste Amendments (HSWA) Permit and as part of its ongoing efforts to decommission inactive parts of the site. Over 80 monitoring wells have been installed on and off site. Approximately 40 wells are routinely (once a quarter or more often) sampled and analyzed for various parameters. The results of this monitoring are shared and discussed with both the TDEC and EPA. Much of this monitoring is being done pursuant to conditions imposed through NFS' TDEC Hazardous Waste Management and EPA HSWA permits. The analytical results and NFS' evaluation of them are routinely submitted to the agencies.

6.3 Ecological Monitoring

The ecology within the vicinity of the NFS plant is described in section 3.0. The radiological monitoring of air, water, vegetation, silt, and soil as discussed in section 4.0; and the chemical monitoring of process water discharges and storm water runoff are the key to the ecological health within the vicinity of the NFS site. These parameters have shown no adverse effects to the ecological system.

Figure 11
Environmental Air Sampler Locations

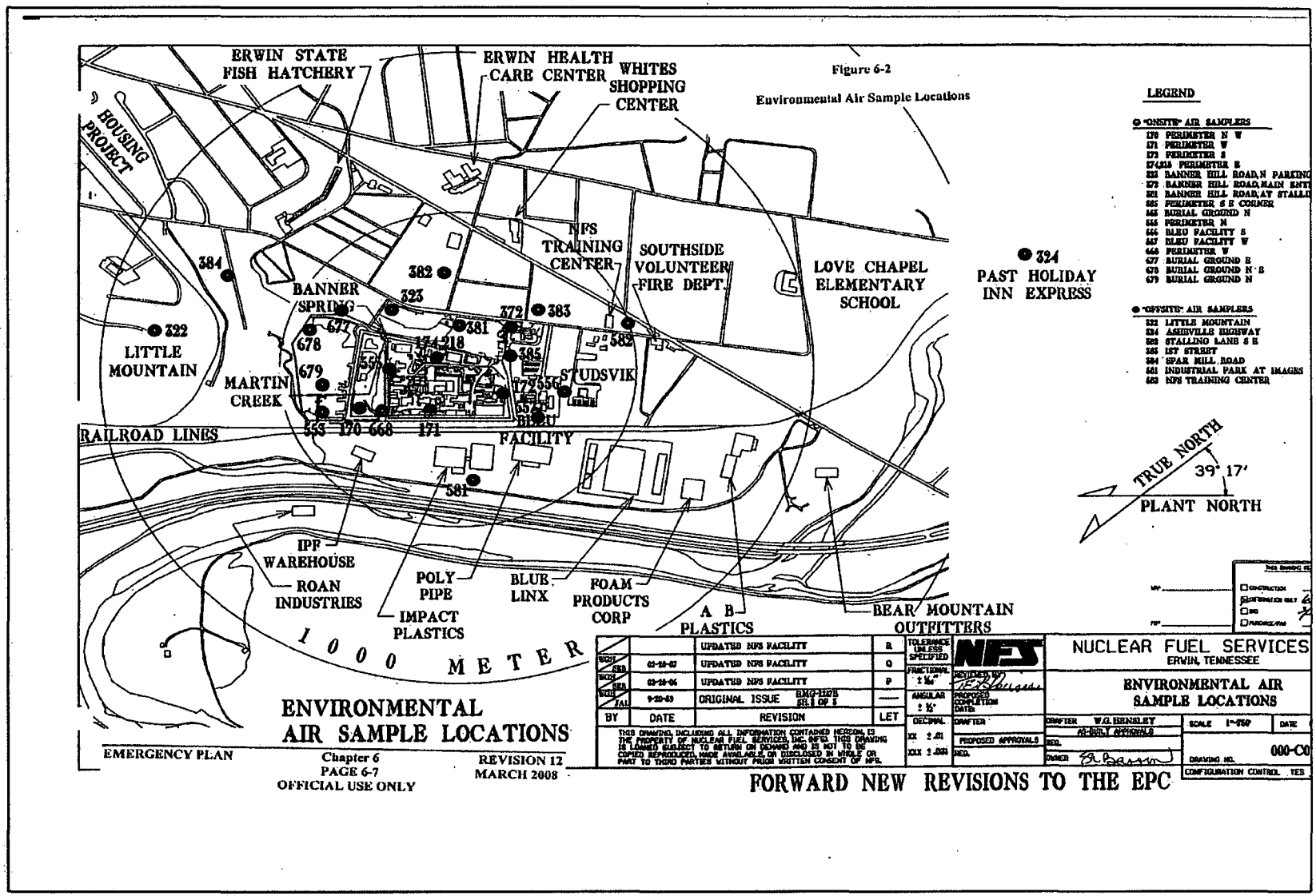
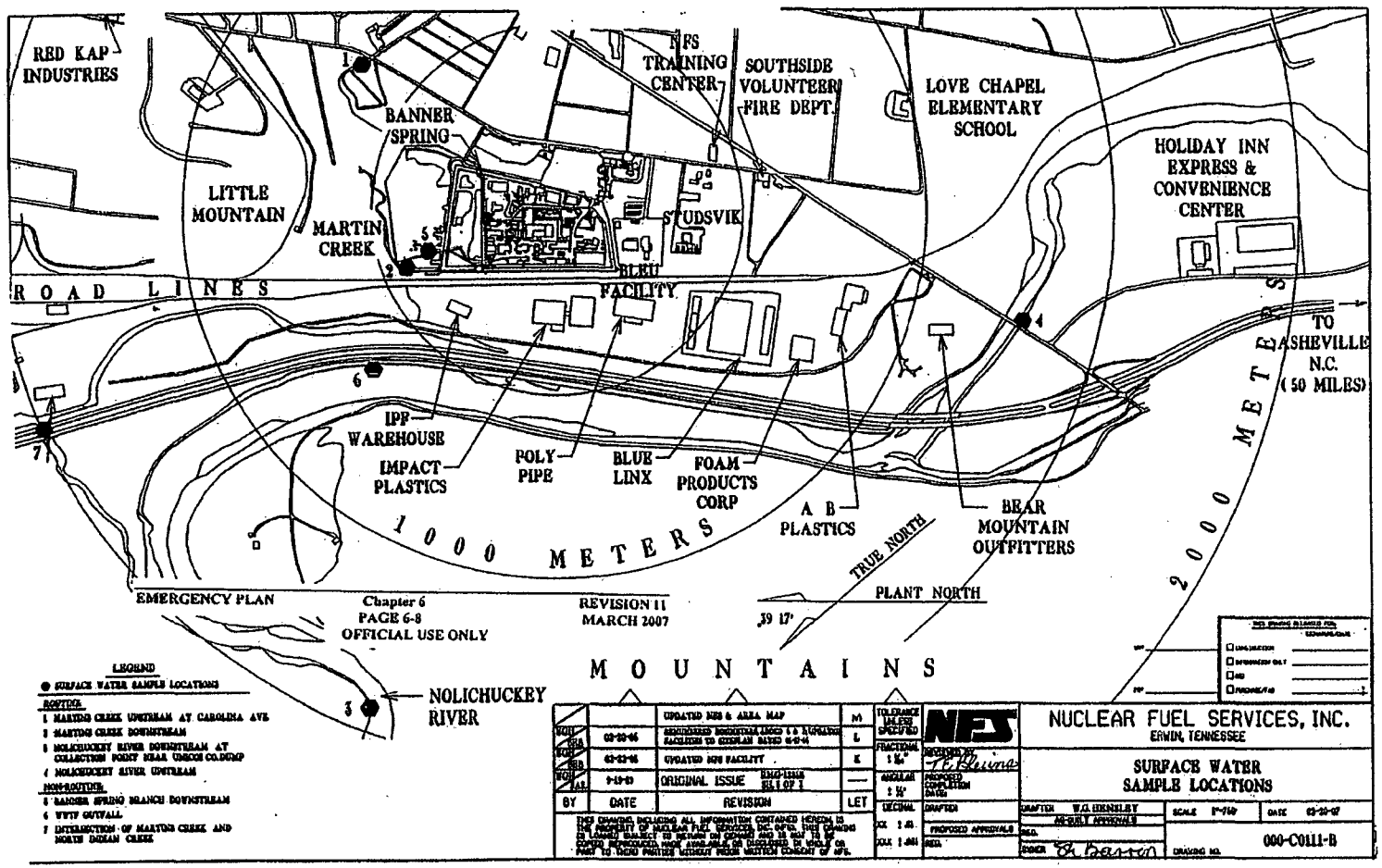


Figure 12
Surface Water Sample Locations



7.0 Cost Benefit Analysis

In accordance with 10CFR 51.45(c):

"Environmental reports prepared at the license renewal stage under sec.51.53(c) need not discuss the economic or technical benefits and costs of either the proposed action or alternatives except if these benefits and costs are either essential for a determination regarding the inclusion of alternative in the range of alternatives considered or relevant to mitigation."

NFS is not required to perform a cost benefit analysis, because there is only one proposed alternative.

8.0 Summary of Environmental Consequences

8.1 Adverse Impacts

Section 4.0 of this report comprehensively describes the direct and indirect environmental impacts of the NFS facilities operation, and the environmental justice-related impacts. The data indicates that NFS' conduct of licensed activities has, and is expected to continue to have, no significant adverse impact on the people, air, land, water, flora, and fauna surrounding the NFS facility in Erwin, Tennessee.

Adverse impacts are noted only for the "No License Renewal" action. The adverse effects are socioeconomic impacts of direct and indirect employment loss in the ROI, the counter-productivity of the nuclear nonproliferation objectives of the U.S. Government, and the negative effects to the U.S. Department of Energy Naval Reactors Program.

8.2 Beneficial Impacts

The beneficial impacts of NFS' licensed activities are:

1. Economic stimulus for the ROI;
2. Nuclear fuel production for the U.S. Department of Energy Naval Reactors Program;
3. The rendering of weapons grade material useless for future military purposes, supporting the nonproliferation objectives of the U.S. Government; and
4. The conversion of surplus U.S. Government material into commercial reactor fuel.

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